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FOR ENGINEERS AND CONTRACTORS CONTROLLING THE DESIGN, SPECIFICATION, INSTALLATION AND MAINTENANCE OF HEATING, VENTILATING AND AIR CONDITIONING.

HEATING & VENTILATING

AIR CONDITIONING

FOR SEPTEMBER, 1939

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DUCTS

The Reference Data sheet for this month has some unique features. It gives the carrying capacity of circular ducts in cubic feet per minute for a wide range of round ducts over the customary range of velocities. See opposite page 42.

AIR CONDITIONING AND CHICKENS

An unusual installation of air conditioning, used in connection with poultry research conducted by the Department of Agriculture, is described in an article beginning on page 23.

FIRE REGULATIONS

The National Board of Fire Underwriters has again revised its regulations relating to the installation of air conditioning systems. If you design or install air conditioning in buildings which will be insured, study the revisions as outlined in an article beginning on page 36.

SERVICING

The servicing of summer air conditioning equipment in the larger cities where there are numerous installations has become a complicated problem. In an article starting on page 28 is described a series of forms used to keep track of material and time and to route service engineers to best advantage.

INDUSTRIAL CONDITIONING

The new plant of Carboloy, makers of high speed tool steel, has an air conditioned metal-mixing room to maintain constant temperature and humidity because of the hygroscopic nature of some of the elements needed in the manufacture of Carboloy. Installation is described on page 26.

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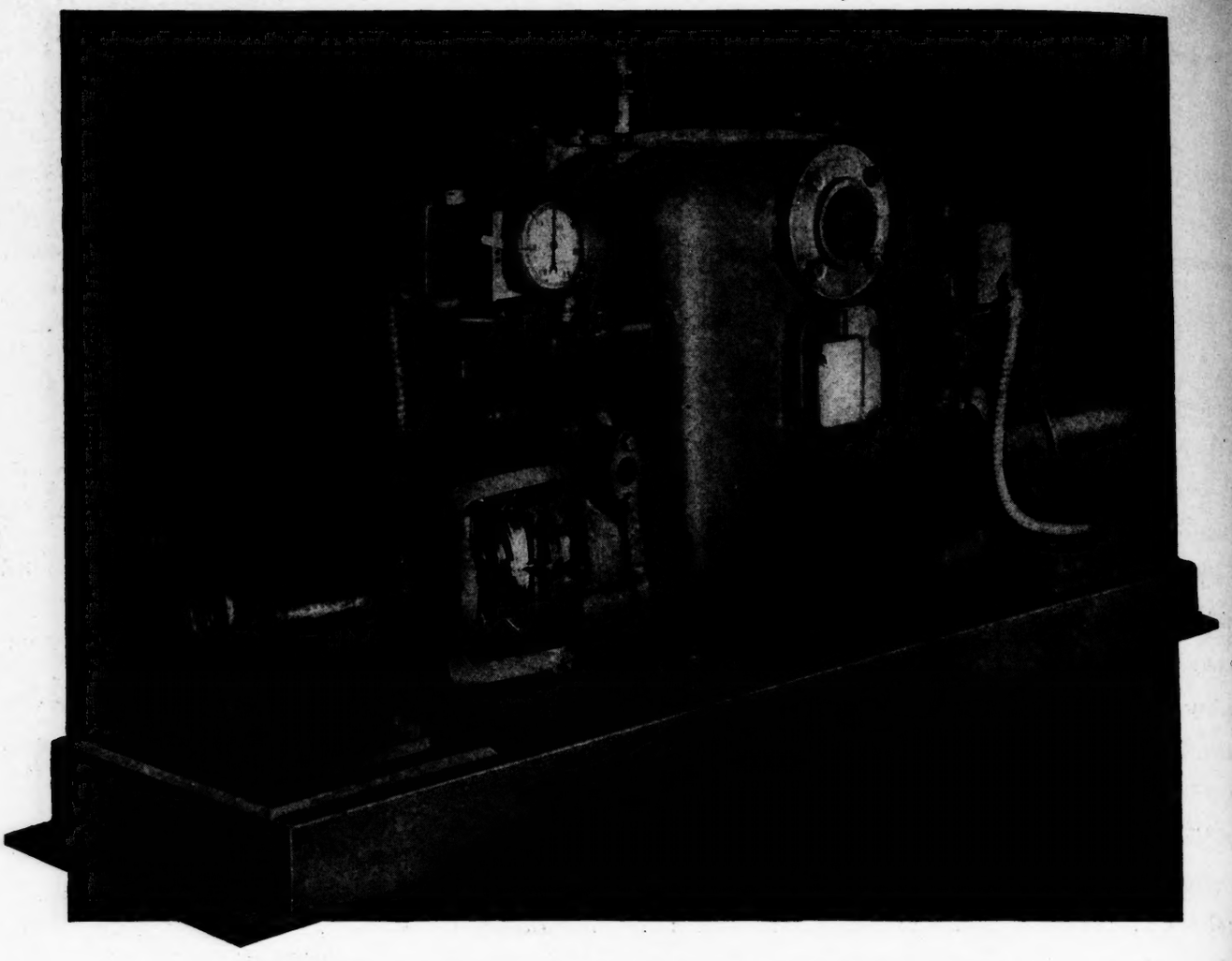

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Fig. 1. Poultry research buildings at Agricultural Research Center, Beltsville, Md. (Left to right), Biological Building, Nutrition Building, Genetics and Physiology Building.

Poultry Research Aided by Air Conditioning

By H. G. BAROTT†

Air conditioning is often extremely useful to research workers in eliminating the variables due to changes in air conditions which would affect their test results. A recent application for this purpose has been in connection with the poultry nutrition research work being conducted by the U. S. Department of Agriculture. In this article the author discusses some of the problems faced by the workers at the Department of Agriculture's Research Center at Beltsville, Maryland, tells how air conditioning had helped them and describes the equipment used.

THE accumulation of information regarding the fundamental character of nutrition comprises one of the most outstanding accomplishments of recent scientific research. Such research can be undertaken only when all the environmental conditions, as well as the nutritional conditions, are under absolute control. Thus the need for air conditioning.

One of the leading centers of this type work is the Research Center of the U. S. Department of Agriculture at Beltsville, Maryland. This center has recently been provided with several new buildings having many air conditioned rooms for the study of problems in poultry and poultry nutrition. Here one will find groups of individuals studying various problems pertaining to poultry. One of these groups is making a study of the nutritional requirements of poultry; and although the investigations are primarily for the poultry industry yet many of the principles and truths discovered are of much importance in general nutrition, including that of man.

Fig. 1 shows three of the four buildings which are at present being used for researches in the poultry industry. In the Biological Building are to be found the mammoth incubators and hatchers, which turn out thousands of chicks each season. The Nutrition Building houses the Respiration Calorimeter Laboratory, for the study of metabolic problems, a description of which appeared in the March, 1939, issue of HEATING & VENTILATING. There are also several other laboratories in this building for the study of nutritional problems. The third building is for Genetics and Physiology; where, among other things, the study of the glandular functions, and the effect of ionized air on poultry, are undertaken.

Fig. 2 shows one of the research buildings which is used for the study of problems in poultry nutrition and to which the rest of this article is devoted.

Refrigerating Equipment for Air Conditioning

The first floor is used to house the feed storage and mixing machinery and the refrigerating equipment. The refrigerating equipment serves to cool the experimental laboratories and storage room on the floors above.

The refrigerating plant, Fig. 3, consists of two three-ton and one ton machines. Each of these machines uses ammonia as the refrigerant, and each has two cylinder compressors of the reciprocating type. The

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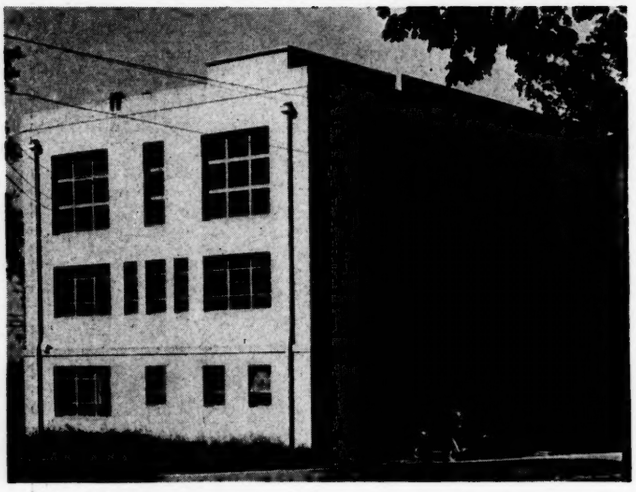


Fig. 2. Research Building with air conditioned laboratories for the study of problems in poultry nutrition.

compressor of one of the machines is shown at (1), the ammonia condenser at (4). The pumps (3) are of the rotary type, and circulate water to cool the compressors and condensers. The brine cooler is directly under the camera and therefore can not be seen in the figure. At the right and just visible, are the brine circulating pumps. Surplus brine is stored in a large tank about 8 ft. wide, 10 ft. long, and 6 ft. high, which is also at the right, back of the brine pumps. The machines (1) and (2) both operate to cool the brine from the storage tank. This brine, in turn, is used to cool the experimental laboratories and storage rooms in the floor above. One cold room, operated at sub-zero temperatures, is cooled by direct ammonia expansion by the 2-ton machine.

A cabinet-type brooder, designed by the head of the Poultry Nutrition Section, Dr. Harry W. Titus, for investigations in nutrition of poultry, is shown in Fig. 4. This is a very essential piece of apparatus in poultry research work. It consists of 72 compartments, made from sheet metal. Each compartment contains a cage, made of wire mesh, which may be withdrawn from the compartment like a sliding drawer. This feature may be seen at (1) Fig. 4. Each compartment is divided into a front and back section by means of a drop curtain. The front section is at room temperature and has a food and water receptacle, which is suspended from the front panel of the cage. The back section is kept at a temperature which is appropriate for the chicks under investigation.

Temperature control is by means of apparatus housed in the compartment (2) at the near end of the cabinet. This apparatus consists of a fan, which keeps the air in circulation throughout the rear half of the cabinet and an electric heater for heating the air to a predetermined temperature. The electric current to this heater is thermostatically controlled so that a uniform temperature is maintained in the cabinets.

When the newly hatched chicks are placed in the compartments the temperature is kept at 94F for the first four days; after this the temperature is gradually reduced, day by day, until by the sixth week it is maintained at 70F. At about this time the chicks are removed to regular chick batteries, which are kept at room temperature.

This cabinet is used in research work of various kinds. One investigation had for its objective the study of various substances to determine their potency as a source of the chick anti-dermatosis factor, sometimes called the filtrate factor. This factor is one of the constituents of the originally so-called vitamin B_2. In the investigation mentioned 72 chicks were selected, and one of these chicks was placed in each of the compartments of the cabinet brooder. These chicks were divided into eight lots of nine chicks each. Two of the lots were used as controls; one control group was fed a basal diet only, the second group was fed this basal diet plus liver, which is a known potent source of the anti-dermatosis factor. Each of the remaining lots was fed the same basal diet plus some supplementary substance which it was hoped would prove a potent source of this filtrate factor. These substances included various grains, wheat-bran washings, molasses, and yeast, as well as various extracts and concentrates. The chicks were kept on the diet for from 8 to 10 weeks unless dermatosis appeared, which proved that the substance being fed did not contain sufficient amounts of the factor sought. In this experiment the findings of other investigators were verified in that they showed that, although many of the substances tried were unsatisfactory, yeast and some of the grains, when fed at sufficiently high levels, supplied enough of the factor to prevent dermatosis.

In research work of this kind it is essential to eliminate environmental effects, therefore the importance of the cabinet. The room in which the cabinet is housed is also equipped with apparatus for both temperature and humidity control. The operation of the equipment is as follows: The air of the room is drawn by a fan through the brine cooling coils. These are enclosed in compartment (3) Fig. 4. From the cooling coils the air passes to the reheater (4). This is a heat interchanger, with many small air passages, and it uses steam as the heating medium. From the reheater the air passes through the duct system (5) to the discharge ports (6). Both the cooling and heating are thermostatically controlled. The humidification is accomplished by the spray nozzles (7). These are operated by compressed

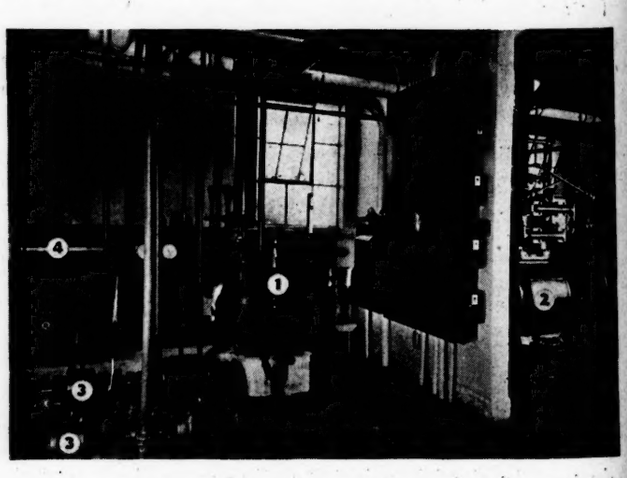


Fig. 3. Refrigeration Plant: 1 and 2, the two 3-ton compressors; 3, pumps for water circulation; 4, ammonia condenser.

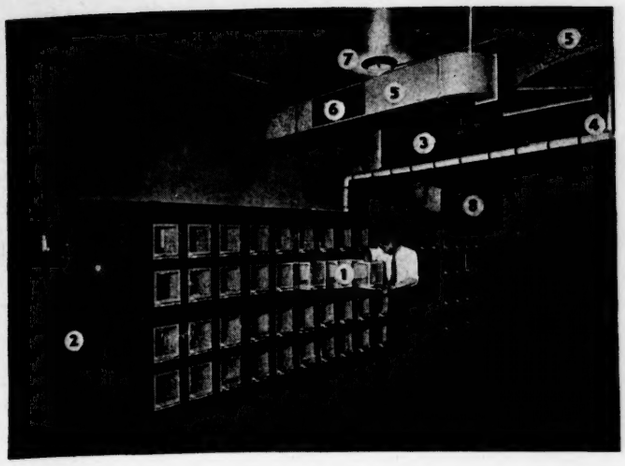


Fig. 4. Cabinet type brooder for young chicks. Self-contained temperature control: 1, chicken compartment; 2, cabinet in which suction fan and heater are housed. Apparatus for room temperature and humidity control: 3, compartment containing refrigerator coils and fan; 4, reheater; 5, duct system; 6, discharge ports; 7, spray nozzles; 8, humidistat.

air and discharge a fine mist directly into the air of the room. The activation of the nozzles is controlled by the humidistat (8) located at the intake port of the air circulating system.

The control system is shown in Fig. 5 and explained in the following description.

As the room air temperature begins to rise the thermostat T-3 allows the air pressure in the reheater steam valve to decrease which causes the steam valve to close gradually. If the temperature continues to rise, the air pressure is further decreased and the cumulator C-2 opens. This causes the three-way air valve to allow air to flow to the cold brine valve and gradually open it. When the temperature falls, the reverse action takes place and the brine valve first closes gradually and then the steam valve opens gradually.

As the moisture content of the room air rises, the humidistat allows air to escape from the line and the cumulator C-1. This causes the spray water valve to gradually close. If the humidity continues to rise, the air pressure is further decreased by the humidistat and the cumulator C-2 operates to open the brine valve regardless of the position called for by the remote readjustable thermostat T-3.

After the brine coil has been in operation for some time, a considerable amount of frost is built upon the surface and it becomes necessary to defrost the coil. This is accomplished automatically by the static pressure regulator R-1.

When the brine coil has too much frost, the static pressure drop across the coil actuates the regulator R-1. This regulator then admits air to actuate C-3 which in turn causes the three-way valve to pass main air, this closing the brine valve V-8 regardless of the position called for by either the thermostat T-3 or the humidistat H-2. When the brine coils defrost sufficiently to allow the static pressure to rise to a predetermined point, then R-1 actuates cumulator C-3 to exhaust, which positions three-way air valve V-9 to allow thermostat T-3 and humidistat H-2 to control brine valve V-9 as described above.

The regulation of both temperature and humidity by this system is very good, so that the experimental research can be conducted without the uncertainty of changes in the environmental conditions.

Other investigations are in progress on the same floor of this building. Among these is the case of the hen battery room where 144 hens are housed in individual wire cages. The temperature and humidity in this room are also kept constant, by apparatus much like that previously described, except that the heating is done by electricity and there is heat control by a preheater before the air reaches the cooling coils as well as by a reheater as the air leaves the cooling coils.

In this room the experimental material (hens) are kept under a controlled routine, on a selected diet, and under fixed environmental conditions. As an example of the type of research conducted, 144 hens were divided into 12 groups, with 12 hens in each group. Diets containing protein were fed to these groups at six different levels, from 13% to 23%, at 2% intervals. There were two groups on each diet, one acting as a check on the other. The object of the test was to determine the effect of feeding protein at different levels on the well-being of the fowls, on the egg production, on the fertility and hatchability of the eggs laid by the groups and on the livability of the offspring.

By these experiments and many others, the Animal Nutrition Division of the Federal Bureau of Animal Industry is accumulating much data, not only for the benefit of the poultry industry in particular but of nutrition in general. The poultry industry produces $430,693,000 worth of chickens (10 year average) and $652,858,000 worth of eggs (10 year average) per year. These chickens consume more than $500,000,000 worth of feed annually. The production of poultry and feed, the care of the flocks, transportation, storage and packing of poultry products, building materials utilized, poultry housing equipment, etc., give employment to a great number of people. Any discovery that will improve the number and quality of the eggs and chicks produced, or that will eliminate disease and reduce mortality, will add materially to the wealth of the country and provide a livelihood for an even greater number of people.

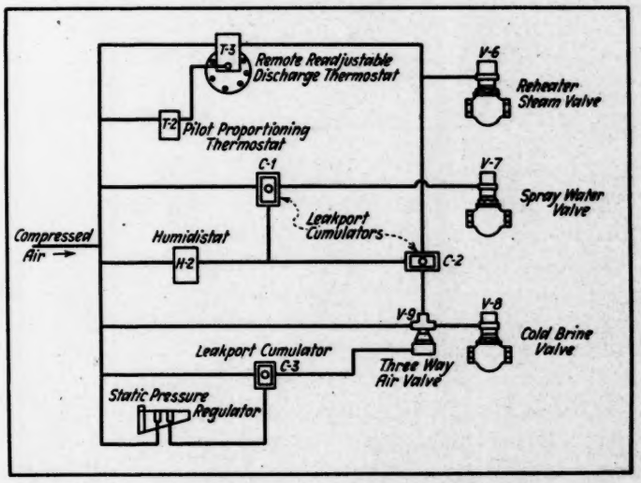


Fig. 5. Schematic diagram of temperature and humidity control for room in which cabinet type brooder is kept.

Metal Mixing Room and Offices Are Conditioned in New Detroit Factory

CARBOLOY COMPANY, INC., a subsidiary of General Electric Co., has formally opened its new $750,000 plant and general offices in Detroit for the manufacture of masonry drills, used for drilling holes in concrete, brick, tile, marble and all other non-metallic construction materials, and also other cemented carbide products. It is claimed that these drills will drill 50% to 75% faster and stay sharp up to 50 times longer than old type drills.

This new plant embraces a total area of 121,750 sq. ft. It is designed throughout for quantity production, and is located on a 40-acre site on East 8-Mile Road. The two-story Administration Building, with an area of 35,556 sq. ft., housing all general office departments such as sales, engineering, drafting, purchasing, and accounting, is of fireproof construction and has a complete system of winter and summer air conditioning.

The factory, which is connected to the rear of the Administration Building, is a one story monitor type structure covering 88,197 sq. ft. and contains the metal mixing room where the exact process of mixing the metals is carried on under the ideal conditions provided by air conditioning in order that the proper temperature, humidity and cleanliness can be maintained.

Summer Operation of Office Building

The conditioning of this building is broken down into three distinct zones, which operate as follows:

One conditioner, equipped with both cooling and heating coils, and a 40 hp. condensing unit supplies what is known as the *North and East zone,* with 14,000 c.f.m. of filtered and cooled or heated air, of which approximately 10% is fresh air. The construction of the conditioner is such that the cooling coils are segregated into two zones, each controlled by a separate thermostat, so that more even control of the temperature may be maintained.

The *South and West zone* is supplied in the same way, but handles slightly less air, its allotment being only 13,000 c.f.m., again with 10% fresh air.

On these two zones, the 40 hp. condensing units supplying the refrigeration are equipped with an automatic capacity reducing control, so that when one of the zones is satisfied, the reduced load on the coils is immediately reflected in the suction pressure at the condensing unit, at which time the machine automatically shuts down to one-half capacity, thus effecting a saving on power consumption.

The conditioned air from the conditioners is supplied to every room through either ceiling or high wall discharge outlets. All of the doors are provided with louvers so that the return air passes into the hall, where it is picked up by the return ducts and sent back to the conditioner.

The amount of fresh air used is controlled by dampers which, when operating on the cooling cycle, are fixed at 10%. In the event it is desired to ventilate the building and completely change the air at any time, a manual switch is provided which opens these dampers wide and admits a large amount of fresh air.

The basement of the office building, which contains a recreation or assembly room, and a cafeteria, is supplied by a separate conditioner, and 15 hp. condensing unit, and is entirely independent in its operation. It supplies approximately 3,000 c.f.m. with provisions to admit 50% fresh air if desired or necessary.

Fig. 1. The new factory and office buildings of Carboloy Company, Inc.

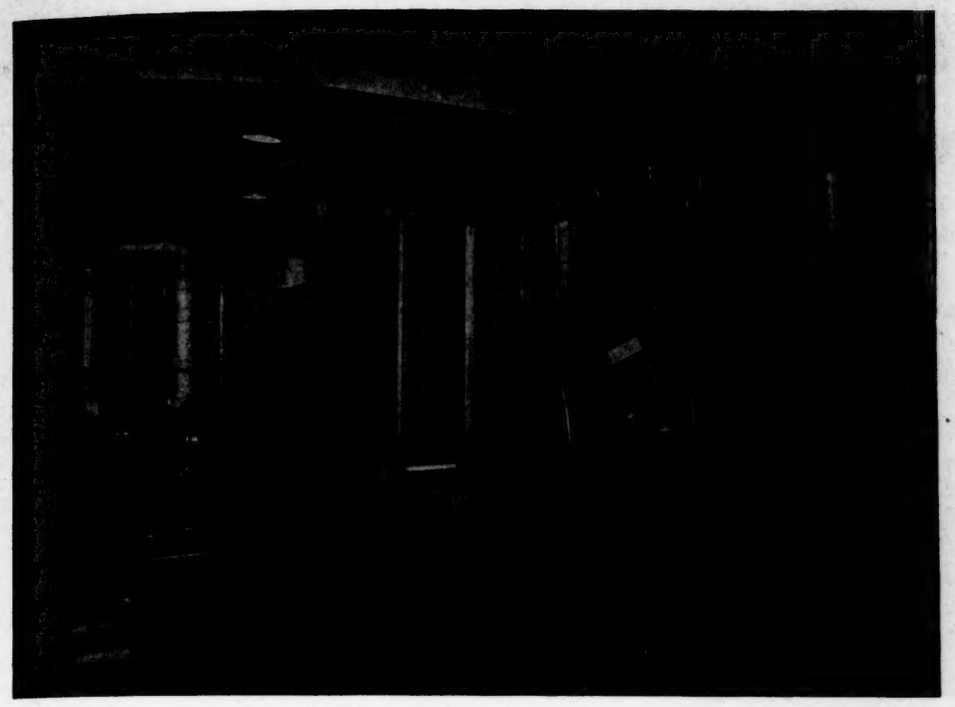


Fig. 2. Central air conditioning equipment for supplying the office building.

Winter Operation of Office Building

The winter operation is very simple in that the air system supplies only tempered, filtered and humidified air to the building, the actual heating load being taken care of by concealed radiation which is supplied by the factory steam.

The temperature of the tempered air is controlled by return air ductstats located in the ducts near the conditioners.

Metal Mixing Room

Due to the hygroscopic nature of some of the elements which go into the making of Carboloy, the temperature and humidity in this room must be maintained at 80F and 35% R.H. for the entire year on both heating and cooling cycles. These conditions are maintained within 1F and 1% R.H. by a 40 hp. condensing unit and air conditioner, which is equipped with both heating and cooling coils and humidifying equipment.

The dehumidifying process is automatically taken care of by the temperature of the cooling coils. The control of this equipment is very ingenious and is centered about a small telechron driven relay, which checks both the temperature and humidity every minute. In the event that the humidity is high but still no cooling effect is required, the condensing unit is started but the steam coil is also brought into operation, so that the air is not cooled too low. It is also possible to humidify the air in the summer in the event that the outside humidity is below the 30% required.

Fig. 3. Equipment for maintaining the close control of temperature and humidity necessary in the metal mixing room.

Air Conditioning Servicing Simplified by Use of Comprehensive Forms

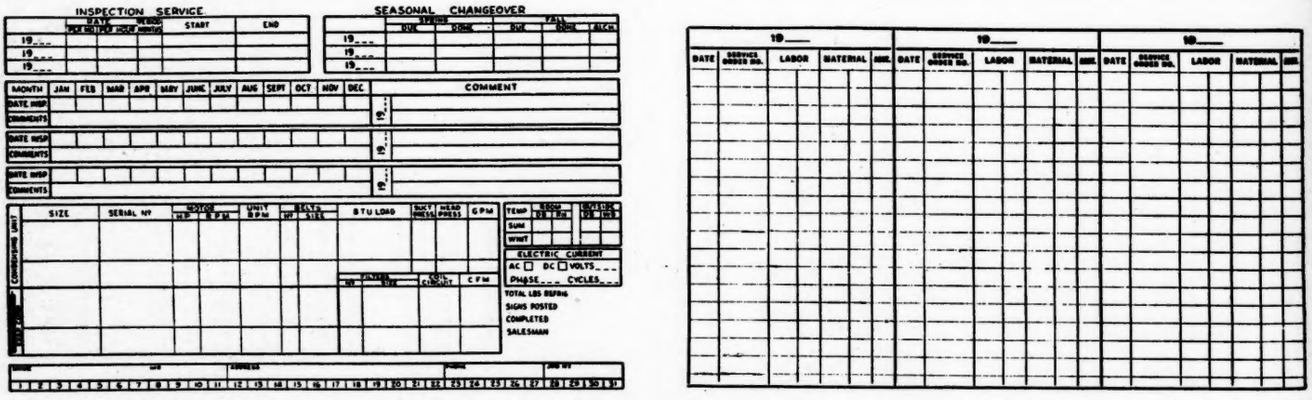
WITH the steady increase in air conditioning installations, servicing becomes more and more of a problem, especially with the larger dealers in densely populated districts. Consequently, it has become more and more necessary for the manager of service departments thoroughly to organize his department so that he can effectively handle the increased volume of business. With such organization it is necessary that the service manager should not be burdened with record keeping and office detail but should be able to devote his time to directing his men, keeping abreast of new methods and improvements, and otherwise operating his department to the best advantage. It is now necessary that the man who heads the service department have executive and ability; this is frequently more important than technical knowledge or ability as a trouble shooter. What record keeping and office routine is necessary should be so simplified that a clerk can handle it.

Probably there are almost as many different kinds of records used for this purpose as there are service departments, and undoubtedly each of these has some advantages and perhaps some disadvantages. The accompanying forms, the result of an extensive investigation into the subject, are presented with the idea that they represent an easily workable system, and one that is now in fairly wide use. Peter M. Fekula, of New York, is primarily responsible for the design of these forms. They are largely adapted from service forms commonly used in the automotive industry with which Mr. Fekula was connected over a period of years as a factory representative of the Ford Motor Company. While these forms or similar forms, serving the same purpose are indispensable to a large dealer, they have been simplified so that the small dealer can make good use of them, too. The small dealer cannot expect to become a large dealer from the service standpoint unless, among other things, he institutes an efficient dispatching system; maintains accurate and accessible records of installations; sees that service orders are properly filled in, signed, checked and routed; carefully stores and controls parts; properly draws up inspection contracts; efficiently follows up servicing, and carefully handles collections.

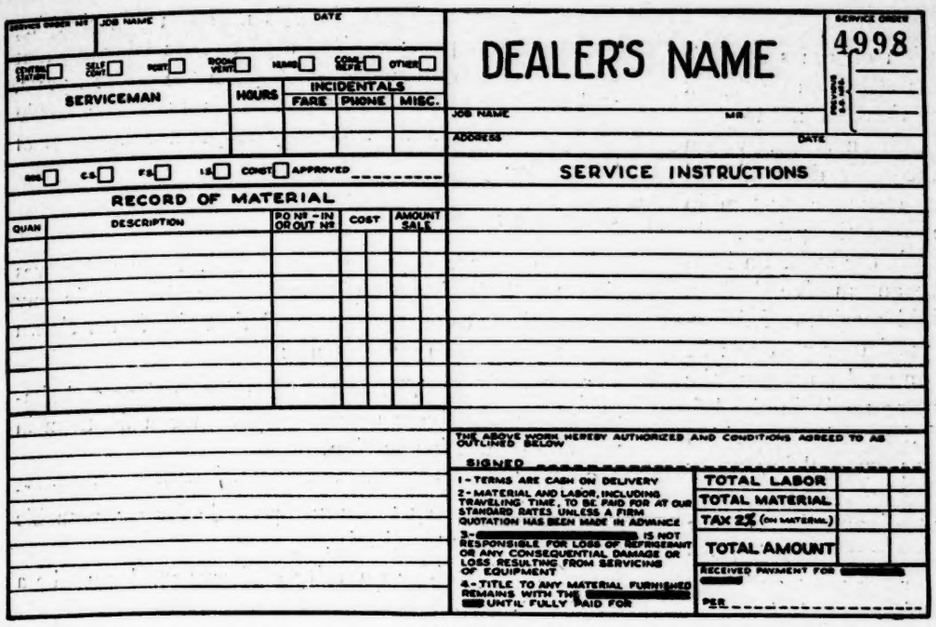
Service Follow-up

Fig. 1 shows the form used for service follow-up. It will be noted that the name of the job, the name of the individual ordinarily contacted, the address, phone number and job number all appear at the bottom of the page. This is so that the forms can be kept in a visible file in a binder with the lower edge protruding, so that any installation can be quickly located. When a service man receives a call he can immediately, while talking, locate the card and have all the information on the installation in front of him while he is carrying on the conversation with the customer. In the upper left hand corner is information regarding the inspection and service arrangement with the customer, including the agreed-upon rate per hour or per month, the number of months in which inspection is desired or agreed upon, and when this period begins and ends. Beside this information, in the upper right hand corner, appears the data on seasonal changeover, including a column for entering when alcohol was used to prevent freezing in the winter. In the middle left hand space are columns for entering the data when the installation was inspected, together with a small space for comments.

General information on the installation is included in the bottom half of the card and shows the size, number, and various physical characteristics of the installation parts. To the right are the design data from the engineering department, together with the electrical characteristics and similar data, all or some of which



This service follow-up card is kept in a visible binder with the lower edge showing. At the left is the front of the card, along which at the left hand edge (not shown) are loose-leaf holes for the binder. Along the lower edge (not shown) are perforations. At the right is shown the reverse side of this form.


DEALER'S NAME

4998

SERVICEMAN | HOURS | INCIDENTALS: FARE, PHONE, MISC.

SERVICE INSTRUCTIONS

RECORD OF MATERIAL

QUAN | DESCRIPTION | PO NR - IN OR OUT NR | COST | AMOUNT SALE

TOTAL LABOR

TOTAL MATERIAL

TAX 2% (ON MATERIAL)

TOTAL AMOUNT

This service order is filled out in triplicate. The blanked out portions indicate the dealer's name.

may assist the mechanic in solving service difficulties.

The extreme bottom strip is a series of numbers indicating the date of the month. If monthly inspection is to be furnished, the date on which the inspection is due is marked by a celluloid tab so that on a given day in the month the service manager can run his eye down over the visible edges of the follow-up card to determine what installations need checking that day. On the back of the card, shown to the right in Fig. 1, a complete service cost record may be kept. Under "Acct." may be inserted the letters C, F, or I, indicating whether the cost was charged for, free, or an inspection.

This record, plus the service orders, give a complete story of the service work performed by the dealer on the installation.

It will be found that this form is convenient and will often be used as a quick reference by departments other than the service department.

To supplement the record most dealers maintain a job folder card in which are complete installation data, correspondence, and other information not frequently referred to.

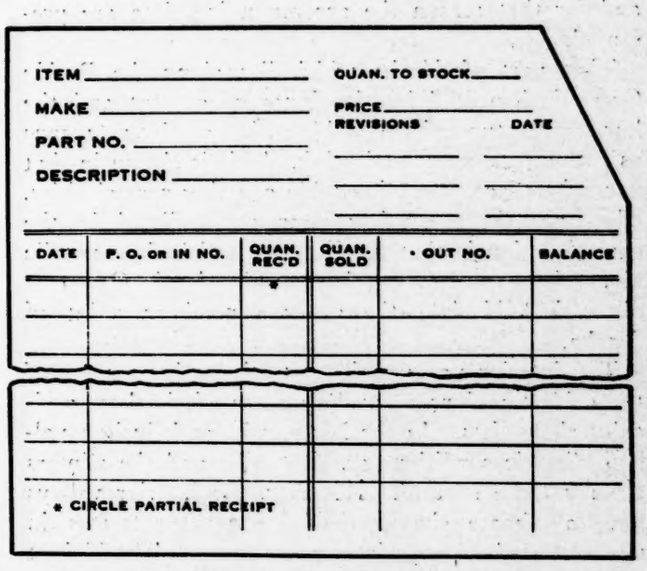
The Service Order

The form shown in Fig. 2 is a service order which is filled in on the job by the mechanic. Service instructions are written in the middle square to the right and the customer's signature is obtained preferably before the work is started. With such a procedure misunderstandings about authorization or terms are minimized. The notes below the customer's signature constitute a contract to which the customer has agreed when he signs the form. On the left hand side of the form information is checked regarding the type of system, immediately below which is space for the service man to fill in his time and expense data. The squares "Reg," "CS," etc., indicate whether the call is a C.O.D. call, charge service, free service, inspection service, or construction. The service man fills in the record of materials used on the job, while the parts man later fills in the purchase order in or out number column.

The service order is made out in triplicate, one copy going to the customer, one to the bookkeeping department and the third kept by the service department.

The number on each service order facilitates tying it in with the billing so that the service order for a disputed billing can be quickly located. One set of service orders can be filed numerically and another alphabetically. This permits quick reference and discovery when a service order becomes lost.

The rectangular portion in the upper left hand corner above "Record of Material," is perforated on one of the triplicate forms. This perforated part allows the bookkeeping department to keep a separate file of information on the pay-roll.


ITEM _____ QUAN. TO STOCK _____

MAKE _____ PRICE _____

PART NO. _____ REVISIONS DATE

DESCRIPTION _____

DATE	P. O. OR IN NO.	QUAN. REC'D	QUAN. SOLD	* OUT NO.	BALANCE

* CIRCLE PARTIAL RECEIPT

A stock card for keeping a perpetual inventory of parts.

Stock Card

In some organizations information on parts stock is recorded in two books—a "stock in" book and a "stock out" book. With such a system there is no way of telling how many parts are still left in stock. When a part is sold a stock transfer record is dictated and considerable time can be lost with such a system in looking up the price of the item from the price book.

Fig. 3 shows a stock card which is the same on both sides and similar to that used by automotive dealers. The cards are classified by celluloid markers of different colors so that the card for a particular part can be located. General information is entered on top of the card and "in" and "out" entries are made in the left and right columns of the body of the card as provided for. The "balance" column is for perpetual inventory purposes.

The corner of the card is cut diagonally so that when a part is sold the card can be reversed so that the full left-hand corner will project on the right and only these cards need to be checked when reordering material. The purchase order and an in-and-out shipment form complete the cycle of stock control and bookkeeping. The stock card is also tied in with the service department, thereby making certain that all material taken into or out of the stock room is properly accounted for and that there is no slip up in charging the owner for parts used on a job. It is desirable that there be a written procedure kept in the service, parts, and bookkeeping departments. This procedure should give in sequence the necessary steps in using each of the forms.

Conclusion

The designer of these forms, Mr. Fekula, believes that the following requirements must be met in any service department system, and that the forms shown here meet these requirements:

1. *Simplicity:* The forms must be so clear and simple that a relatively untrained person can fill them in with minimum instruction.

2. *Fool proof:* There must be no loop holes for errors so that the system must provide for a reasonable number of counter checks.

3. *Quantity:* The quantity of forms used must be a minimum.

4. *Control:* The system must exercise complete control over the operations for which it is devised.

5. *Flexibility:* The system must be flexible so that a given entry need not be made immediately but can wait until it is convenient to enter it.

Alaskan Climatic Data

The recent proposal of Secretary of the Interior Ickes to open up Alaska for refugees in rather large numbers has focused considerable attention on this territory of the United States. The heating engineer is, of course, concerned with the climate of this region and for that reason the accompanying data are presented.

That part of Alaska which lies along the Pacific Ocean is benefited by the Japanese current and the low temperatures through this region are by no means as extreme as one would think. This is shown in that part of the accompanying table covering coastal cities. The only extremely low temperature listed in the coastal region is that for Barrow, which does not lie along the Pacific Ocean but on the Arctic Ocean at about 71° N. lat.—the extreme northern point of Alaska.

The interior valleys of the territory have some of the coldest regions as well as some of the best agricultural districts. In the Matanuska and Susitna valleys climatic conditions are favorable and the winters are not quite so cold. However, the interior valleys have a climate characterized by great extremes in temperature between winter and summer. The highest temperature recorded in Tanana is 91F in the summer whereas the lowest temperature is — 76F.

Heating engineers in this country are accustomed to thinking of degree day loads per season in terms of from 3000 to 10,000 degree days; the maximum in the United States is at Dome Lake, Wyoming, which has 11,614 degree days per normal season. Consequently, the Alaskan totals are rather startling, ranging from about 7500 to as high as 20,000 degree days per season.

WEATHER DATA FOR ALASKAN COMMUNITIES

Town	Lowest Recorded Temp., F	Design Temp. Range,* F	Number of Degree Days, Normal Season
Coastal Region			
Juneau	— 15	0 to — 10	8,356
Sitka	— 4	+ 10 to 0	7,810
Coal Harbor	— 19	0 to — 15	9,417
Seward	— 20	+ 5 to — 15	9,602
Barrow†	— 55	— 35 to — 45	19,970
Interior Valleys			
Fairbanks	— 65	— 45 to — 55	14,342
Tanana	— 76	— 55 to — 65	15,442
Matanuska	— 34	— 14 to — 20	11,589

*Probable limits between which the design temperature would be selected.

†At the extreme northern tip of Alaska.

ARE YOU BUYING AN EXHAUST SYSTEM?

Part 2—What about Fans, Fan Motors and Fan Drives?

By F. F. KRAVATH†

The second of a series of three articles in which the author offers suggestions from his own experience to those who are purchasing exhaust ventilation equipment. The first article can be found in the August, 1939, issue of HEATING & VENTILATING, beginning on page 16. The third will appear in an early issue.

WHILE the old style planing mill exhauster is by far the most prevalent type of fan in exhaust work, it is not as efficient as modern forward curved or backward curved blade fans. Since in most early exhaust systems, all the air borne material passed through the fan, it was and still is essential in this type of system, that the blades be ruggedly constructed for strength and resistance to wear and that they be radial to prevent an accumulation of material on the blades which might result in disastrous unbalance. Since most modern systems are designed so that the fans handle only clean air, any one of the three previously mentioned fan types may be suitable, as well as some of the disc fans recently developed for high static pressures. In general, the backward curved blade fan is the most efficient, runs at the highest speed, is the quietest in operation, is non-overloading with a drop in resistance at constant speed, handles more air for a given wheel diameter than the steel-plate fans, but materially less than the forward curved, and has ruggedly constructed long and wide blades. The forward curved or multivane fan is the smallest for the amount of air handled, is more efficient than the steel plate fan, runs at a higher speed, has the maximum range of capacity with minimum variation of developed head causing a tendency to overload with drop in resistance, is the least ruggedly constructed, and is relatively wide and small in diameter. The steel-plate, or planing mill exhauster, is the lowest speed, least efficient, noisiest, tallest and narrowest but withal one of the most dependable of all types. Efficiencies of disc fans are comparable to those for the steel plate fan. Since the disc fan is apt to be the cheapest of all, it is well to consider it where economy is of prime importance. Disc fans find their best applications in clean air or gas handling.

While modern fans offer slightly higher efficiencies than older fans, sometimes excellent second hand and rebuilt fans can be obtained at a fraction of the cost of a new fan. Many times there will be a number of fans available in a company's own machinery storage or perhaps fans will be in service where they are far too large or too small, which fan might be admirably suited to a pending job or another location. In ten exhaust systems designed by the writer within the last year, in only one case was it necessary from an overall cost standpoint to purchase a new fan. All that is generally necessary in the way of overhauling a new fan is to replace the bearings (always use ball or roller bearings in dusty locations), rebalance the wheel statically with an eye toward improving probable dynamic unbalance, tighten side sheet to bearing stand, and scroll sheets to side sheets, replacing worn sheets where necessary. Where side sheets have become warped or static pressures to be developed will be high, stiffen side sheets with as many angles as are necessary to eliminate warping. Where stiffening angles may be welded, it is preferable to bolting unless lock washers are used since the high-frequency low-amplitude fan vibrations can loosen even extremely tight bolts. Stiffening, as mentioned, will definitely reduce destructive vibration to a minimum. Mounting the fan on a vibration absorbing base will tend to keep the vibration from being passed on to the building structure.

It is imperative that fans be chosen with efficiencies balanced against first cost. The mere fact that the main duct is of a certain diameter close to the fan inlet is not sufficient reason to specify a fan with an inlet the same or almost the same diameter. A well-designed exhaust system will generally have relatively low main velocities, necessitating large pipe diameters for a given volume, yet the fan outlet velocity for good efficiencies will be higher in many cases, hence a smaller fan.

It is well to bear in mind the following fan laws, whether in designing or in buying:

For a given size fan connected to an exhaust system, with constant air density:

Capacity is directly proportional to speed.

Head is directly proportional to the square of speed.

Horsepower is directly proportional to the cube of speed.

For a constant pressure, density, and point of rating:

Capacity and horsepower are proportional to the square of the fan diameter.

For a series of fans operating at constant r.p.m., point of rating, and density:

Capacity is directly proportional to the cube of the diameter.

Head is directly proportional to the square of the diameter.

Horsepower is directly proportional to the fifth power of the diameter.

†Asst. Plant Engineer, Abrasive Company, Philadelphia.

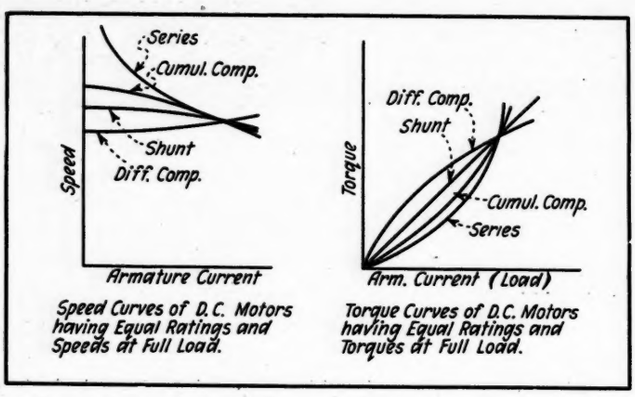


Fig. 4. Performance curves for d.c. motors.

Motors

Most exhaust installations are powered with a.c. motors because of the wide distribution of this type of current. Polyphase motors with the squirrel-cage and the wound rotors are well adapted to fan service. The squirrel-cage motor is essentially a constant speed motor with fair starting torque. Since there is no electrical connection between the moving and stationary parts this type of motor is proof against possible danger from sparking. While the squirrel-cage motor drops off in speed somewhat with an increase in load, if at full-load speed we do not exceed the motor rating satisfactory conditions will prevail. The wound motor or slip-ring motor has windings which are connected to the external circuit through slip rings on the armature shaft. Where it is desired to reduce the speed of the fan, as with reduced load on the exhaust system, the use of the slip-ring motor is more efficient than the use of the squirrel-cage motor with damper control. Synchronous motors are occasionally used for fan drives in large installations where the load is more or less constant, where the starting torque is low, and where a leading power factor is desired and can be utilized. For ordinary run of the mill service, the squirrel-cage motor is the most practical polyphase motor. Where direct current is available, the motors used are shunt, series, or compound wound. All of these types are suitable for speed variation and in general are very ruggedly built and quite adaptable to fan service. While d.c. motors are furnished in standard speeds of 1750, 1150, 860, and 675 r.p.m., approximating the full load speeds of a.c. induction motors, they can be furnished in any speed where direct connection, as by coupling, is desired. The shunt wound motor is the best suited to exhaust work whether the fan to be used is centrifugal or the newly developed high static disc fan. However, when using disc fans it is best to provide motoring for the static no delivery point on the operating curve since for many designs it constitutes the maximum power requirement. Where starting may occur against a closed damper, and a disc fan is being used, it is best to use a series motor because of its high starting torque. However, when using a series motor, it is essential that it is directly connected to the fan to prevent running away. The shunt motor is practically a constant speed motor falling off only slightly with increase of load, whereas the series motor slows up decidedly with an increase in load. The compound motor, developed to give high starting torque with a definite no load speed, represents a compromise between the shunt and series motors in performance. Having both a shunt and a series field, it is generally wound so that the respective magnetic fields are additive, hence being called cumulatively compounded. Although infrequently used, differentially compounded motors, in which the shunt and series fields oppose each other can be furnished. This type of motor has relatively low starting torque and can be made to give constant speed against varying load, or even increased speed against increased load. In Fig. 4 are some typical torque and speed curves for d.c. motors. From a glance at the curves, it can be seen that the shunt motor is the most ideal for exhaust work. Since shunt motors can be furnished with variable speed controls at slight extra cost in which it is possible not only to drop the speed 50% but to increase it 25%, through varying the armature resistance and field resistance respec-

TABLE 2—APPROXIMATE FULL LOAD SPEEDS FOR "SQUIRREL CAGE" MOTORS

Synchronous Speed	60 Cycle Frequency						25 Cycle Frequency		
	3600	1800	1200	900	720	600	1500	750	500
Small Motors ...	3400 3500	1740	1140	860	685	570	1440	710	475
Large Motors ...		1750	1150	850	690	570	1450	720	480

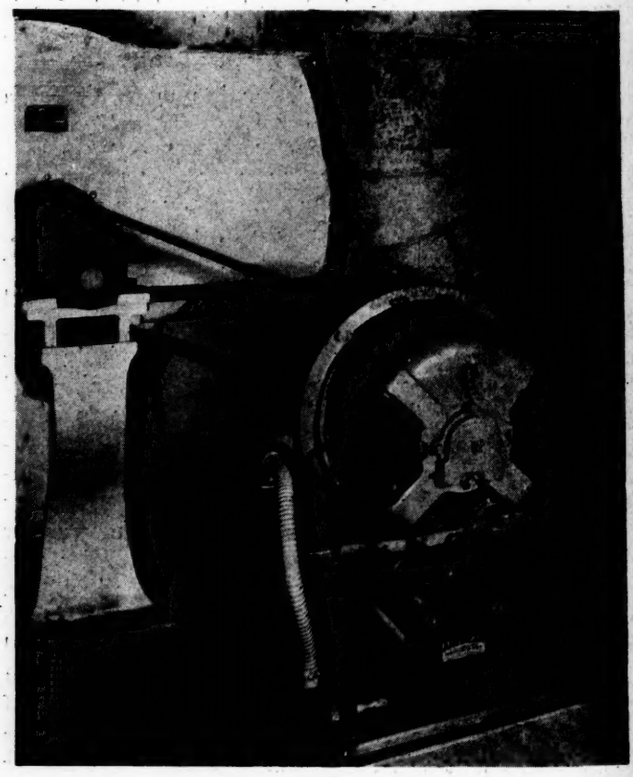


Fig. 5. A tension control, pivoted, motor base, which utilizes the reactive torque of the motor to tighten the belts.

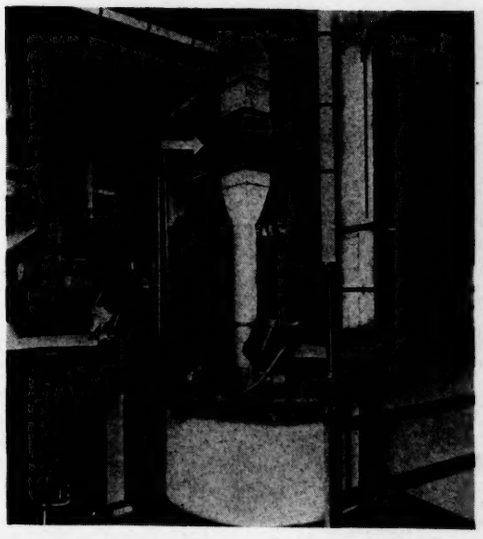
tively, it is evident that the shunt wound direct current motor is the most flexible of all standard motors for fan drives in exhaust work. Where a motor is available for a fan drive in a d.c. application and is other than a shunt motor, great care must be exercised in determining the performance characteristics because of the wide variation existing at times between full and fractional load.

Drives

Many people prefer a direct connected installation of a fan and motor. The writer has found from experience that for ordinary exhaust work, it is far more practical to have belt driven installations. Since plant conditions are ever changing, with methods varying and new processes being developed, exhaust requirements are bound to change. Many times all that is needed is a slight change in the speed of the fan. Where variable speed motors are used, the change is easily made, while with a direct connected constant speed motor nothing can be done. Hence, either poor dust or fume control results or a waste of power occurs. Where the change in speed required is approximately 25% to 30% downward the method of increasing the armature resistance is not recommended, since not only does poor efficiency result from this type of regulation when carried this far, but since the motor load may have dropped as much as 65%, the motor itself due to low load will be inefficient. For increases of speed in the same amount, it will be generally found that the motor size is insufficient to take the new load. For all cases where variable speed motors are not available whether or not the fan is to be driven at one of the standard motor speeds, it is recommended that belted drives be used. The short center drive has proved itself economical and dependable. Where a motor base for automatically adjusting belt tension to momentary load is used, belt life is increased, fewer or narrower belts with correspondingly narrow pulleys may be used, while belt slip may be practically eliminated. (See Fig. 5.) The writer has had some very favorable experience with this type of drive and recommends its use heartily. Continuing with the arguments against direct connection, invariably the fan shaft and motor shaft centerlines are of different heights from the floor. This necessitates the construction of a rigid motor platform, another item of expense to be considered, inasmuch as the platform in any other location might be worthless, while any other motor on the same platform might be just as bad. When balancing such a picture against the extreme ease with which a pulley may be changed—and a pulley of the right diameter can always be used again whether the bore has to be bushed or enlarged—it is increasingly plain why more fan drives are being belted.

Solving a Solvent Production Problem

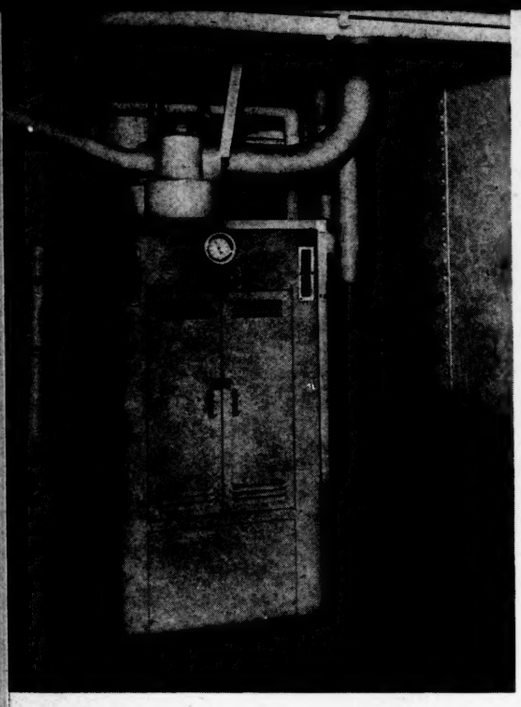
AT Rochester, New York, the Puritan Soap Company has broadened its activities from the pioneer chemical art of soap manufacture to include, among other things, solvents. Now, solvents perhaps are leading the chemical compound field in the matter of variety and new applications. The manufacture of the particular solvent discussed here involves the production of a gaseous material which must be exhausted. Up until recently, states *Trane Weather Magic*, this was accomplished by the sole means of a duct incorporating an exhaust fan and extending from the processing equipment to the roof of the factory building.

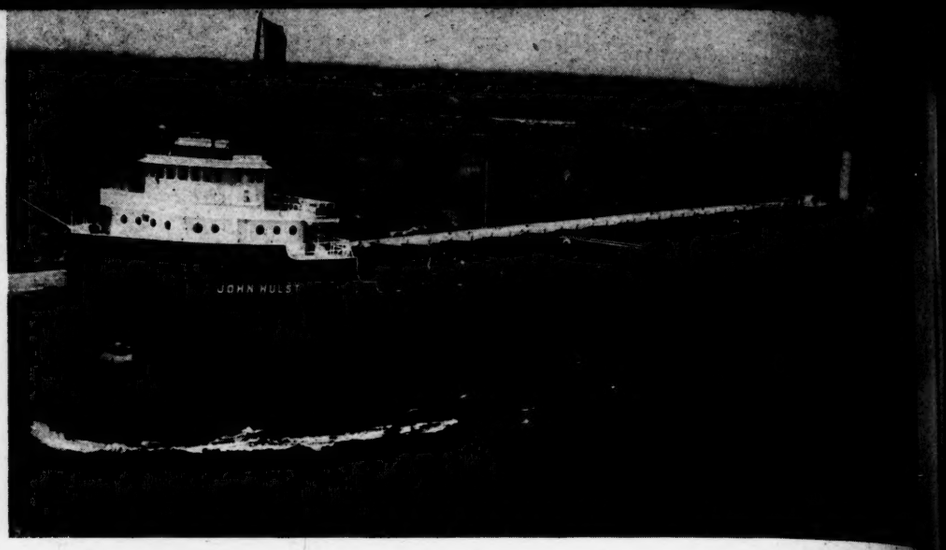


This exhaust system worked splendidly—in fact, so splendidly that an appreciable quantity of the manufactured solvent was exhausted along with the gaseous material. This serious fact created a problem of factory production and economy. Let's see how this problem was solved.

A coil with copper tubes and fins was inserted in the duct as shown in the illustration. City water is circulated through the coil for condensing purposes, and the result is almost magical. This water varies from a low of 50F during the winter season to as high as 70F in summer. By condensing the solvent out of the exhaust air, and, consequently, returning it to the processing equipment, the coil achieves a remarkable manufacturing economy. Actually, between 75% and 80% of the solvent which formerly was lost in exhausting the gases is now saved. This loss amounted to between 24 and 26 pounds per batch, whereas the loss is now between 4 to 6 pounds. This method also reduces the temperature of the gaseous solvent from over 300F to below 100F.

The coil used was a Trane 8-row serpentine coil and the contractor was George Lassen, Inc., of Rochester, New York.

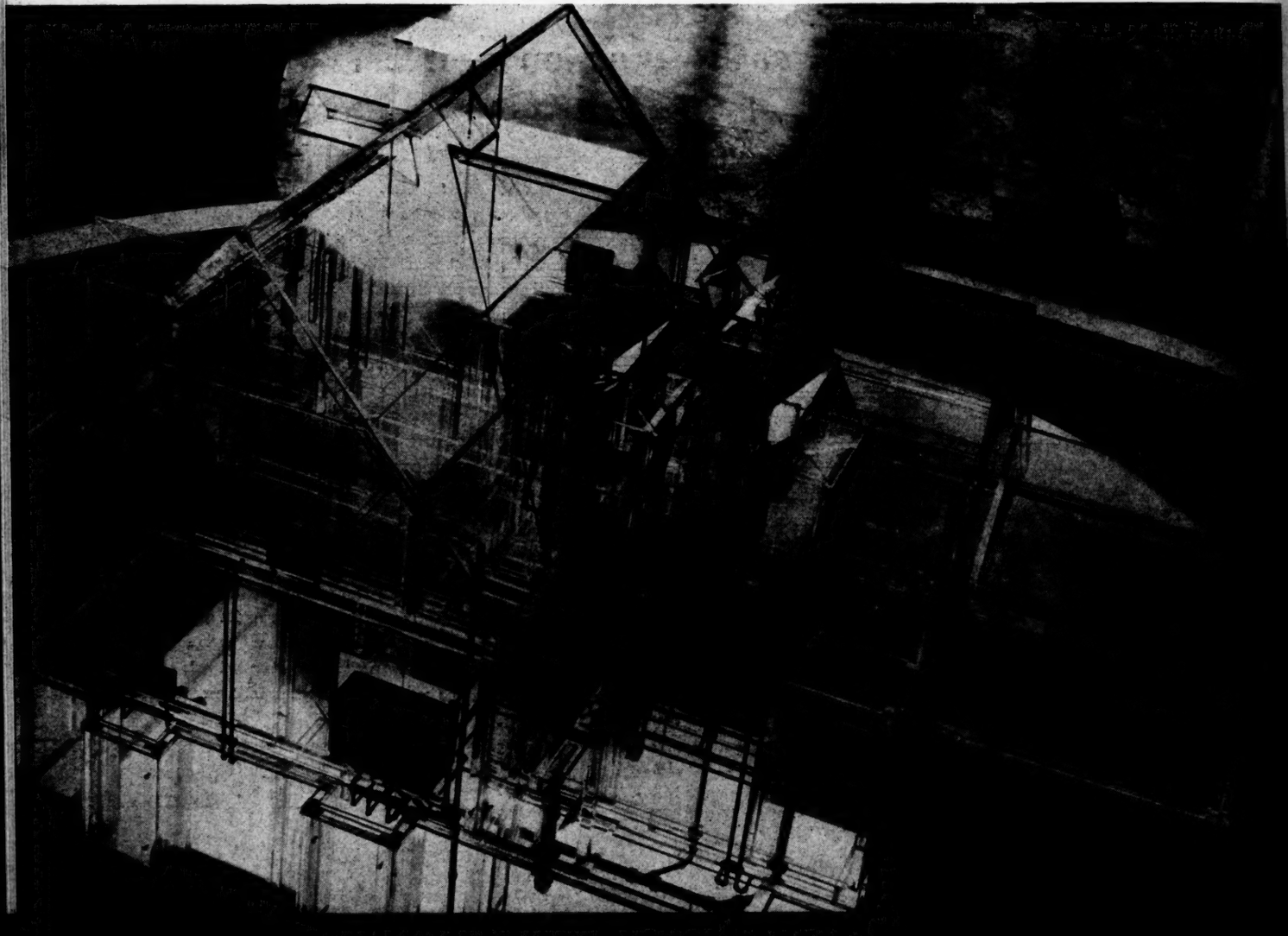


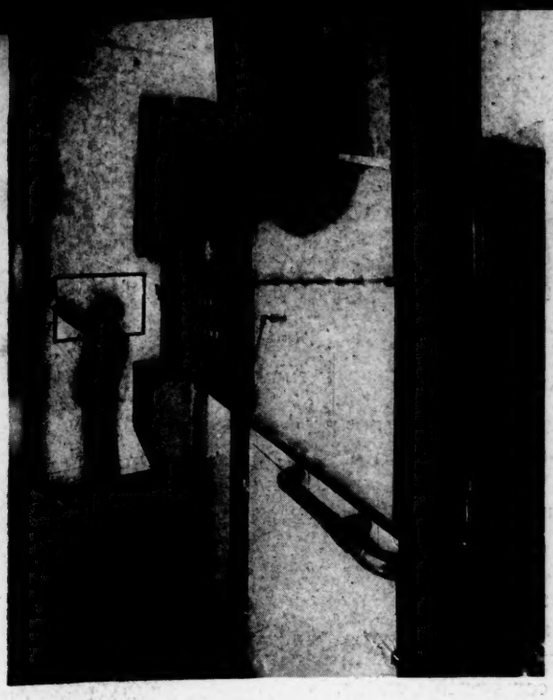


STOKER GOES TO SEA. A modern stoker-fired heating system in a novel instal- tion recently completed on the new Great Lakes ore freighter "John Hulst." The s (above) was built for the Pittsburgh Steamship Co., at the Great Lakes Engineer Works of River Rouge, Mich. An Iron Fireman Stoker (left) conveys coal from bin boiler. The ventilating system includes two blowers which are mounted on the deck supply outside air to the galley, mess room, officers' dining room and cabins.

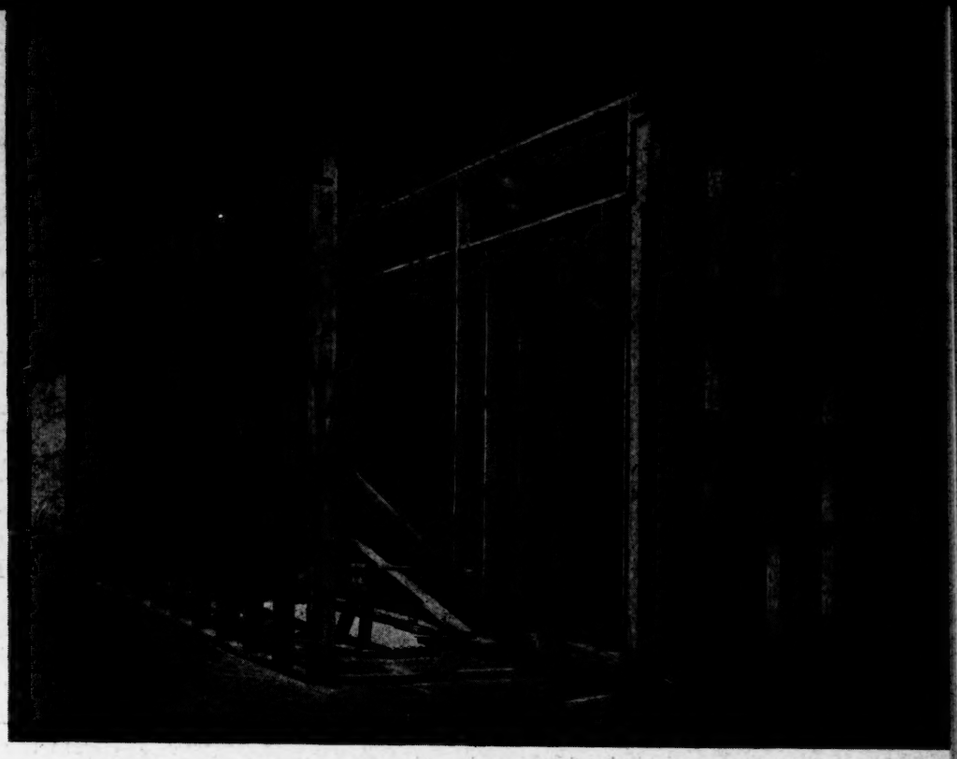
Picture Paragraphs

TRANSPARENT HOUSE. A giant microscope focused on a glass house in which complete plumbing and heating systems are revealed is stopping the crowds in the Crane Company exhibit at the New York World's Fair. Having caught the casual visitor's attention with this unique device it leads him to the more purposeful business of scanning plumbing and heating equipment in actual settings in the Town of Tomorrow exhibit.





REFRIGERATED HEAT. Main control panel of the reverse refrigerated cycle installation in the Emeryville, Calif., plant of Westinghouse. The refrigerating plant cools the building in the summer, heats it in the winter.

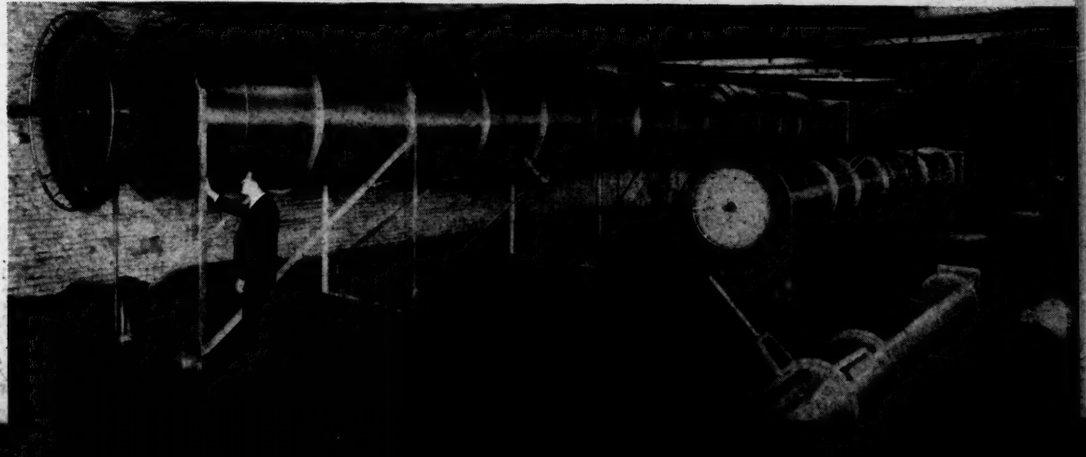


A TEMPORARY BOILER has been erected outdoors by Cleveland's Hotel Statler for use during modernization of the boiler room. Two steel boilers and stokers are being installed by Smith and Oby Company of Cleveland.

BOUND FOR KHYBER PASS and far-off India which lies beyond is this streamlined air conditioned luxury liner on wheels bearing the expedition of L. C. Thaw on a picture-taking trip. A 4-cylinder gasoline engine runs the automatically-controlled Frigidaire compressor.

HOTEL HEAT FOR A CONSTRUCTION CABIN which will be used for only 18 months! Installation of 4 large oil boilers has been made in these construction cabins in Massachusetts, to heat the rough shacks on a water-works construction project. The G.E. boilers supply a forced hot water system.

FAN TESTING LABORATORY of the Utility Fan Corporation, Los Angeles, recently completed. The largest of the three ducts is more than 70 ft. long and will test a blower with a 54-in. wheel.



Fire Underwriters Revised Regulations on Air Conditioning Installations

Important changes have been made in the regulations of the National Board of Fire Underwriters for the installation of air conditioning systems. The accompanying article indicates changes made in these regulations so far as they relate to installations in buildings other than residences.

TWO years ago the National Fire Protection Association recommended a number of changes in its regulations dealing with the installation of air conditioning systems. These regulations, also adopted by the National Board of Fire Underwriters, covered air duct systems of all kinds excepting those for dust or fume removal; they were divided into two parts, the first part covering air duct systems except residences, while part two covered residences.[1] The purpose of these regulations was, and is, "to prescribe reasonable provisions based on minimum requirements for safety to life and property from fire."

A further revision of these regulations has now been made, and the complete regulations published under date of August 1, 1939.[2] New or revised paragraphs are those relating to duct coverings, return ducts, automatic dampers, air inlets and outlets, filters, fire alarm connections and controls. A new section on maintenance has been added and the new ASA safety code for mechanical refrigeration[3] is referred to for cooling jobs in place of old detailed requirements.

Duct System

A new paragraph (114A) relating to combustible coverings of ducts is included as follows:

"Combustible coverings or combustible exterior insulations should not be used generally, particularly in concealed locations of non-fire resistive construction, unless covered with a cement or gypsum plaster coating of ¼-inch. thickness. On ducts with entering air temperatures exceeding 175F combustible coverings shall not be used.

"Work involving the use of torches shall not be undertaken on ducts until the system has been shut down, the duct cleaned and all combustible lining and covering material has been removed from the portion of the duct being repaired."

In order to prevent possible accumulations of dust, new requirements have been set up in a paragraph (117) relating to return ducts as follows:

"Return ducts, other than vertical, shall be so constructed that the interior is accessible to facilitate the cleaning of possible accumulations of dust and combustible material in them, except that accessibility is not required where all of the following conditions prevail:

"(a) The occupancy is not productive of combustible material, such as lint, dust, greasy vapors, etc. Such occupancies are banks, office buildings, churches, hotels and institutions (but not kitchens, service rooms and manufacturing portions).

"(b) The return openings are at least 7 ft. above the floor or are protected by corrosion-resistant metal screens of at least 14 mesh installed back of the grilles so that they will not draw in papers, refuse, cigarettes and other combustible solids.

"(c) The minimum design velocity in the return from the particular occupancy is 1000 ft. per min.

"Clean-out openings at approximately 20-ft. intervals shall be provided where accessibility to facilitate cleaning is required and where the ducts are smaller than 18 x 24 inches. Removable grilles may be accepted as clean-out openings.

"Supply ducts, other than vertical, shall conform to the above regulation for return ducts, unless all of the supply air passes through either water spray or filters."

The 1937 regulations stated that approved fire dampers should be provided at outlet and inlet openings to or from vertical ducts whenever ducts pass through floors and serve more than one story. The new regulations are somewhat more specific and the paragraph (135) has been expanded as follows:

"Where ducts pass through floors, approved fire dampers shall be provided as follows:

"(a) Where such ducts serve only one floor, only one fire damper shall be required in the main supply duct from the unit and only one in the return.

"(b) Where such ducts serve two or more floors, fire dampers shall be required at each direct outlet or inlet and in each branch duct at its junction with the main vertical duct. Dampers are not required at room openings in the branch duct.

"Dampers provided in ducts used solely for exhaust of air to the outside, shall be installed in such a way that they will not interfere with the flow of air in the main duct. No dampers are required in a system serving only one floor and used only for exhaust of air to the outside. Dampers should be designed to close in the direction of air flow."

Cases have arisen in the past few years where refuse accumulated in ducts due to cigarette stubs, pieces of paper, matches, and so on, has found its way into the duct system through the grilles. In order to prevent so far as possible such a situation arising in the future and which would constitute a fire and smoke hazard, three paragraphs (142, 143, 144) have been added:

"Discharge and exhaust air openings and recirculating air intakes shall be located at least 3 in. above the floor, except that protected floor inlets may be permitted under seats, in theatres. When located less than

[1] These 1937 regulations (not including those for residences) were reprinted in HEATING & VENTILATING in July, 1937, pages 53-58.

[2] Published by the National Board of Fire Underwriters, 85 John St., New York, as NBFU pamphlet No. 90.

[3] See "A Review of the American Standard Safety Code for Mechanical Refrigeration", HEATING & VENTILATING, August, 1939, pp. 39-42.

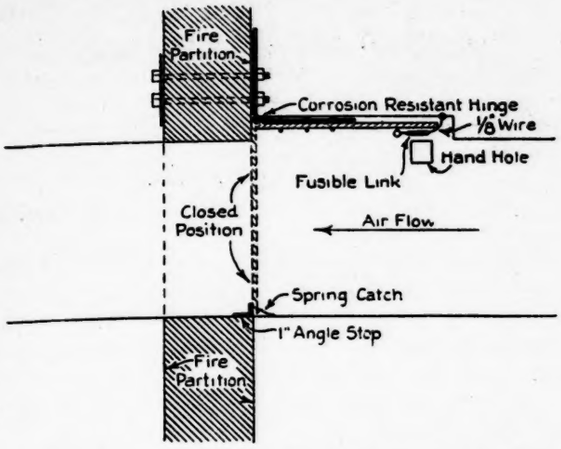


Fig. 4. Typical arrangement of automatic hinged damper. Numbering of the illustrations reproduced in this article is that of the Regulations. Figs. 1, 2 and 3 are identical with those published in the 1937 Regulations referred to in footnote 1.

7 ft. above the floor, inlet and outlet openings shall be protected by a substantial grille or screen, through the openings in which a ½-in. sphere will not pass.

"Fresh air intakes shall be protected by screens of corrosion-resistant material not larger than ½-in. mesh.

"Care should be exercised in choosing the location of fresh air intakes to avoid drawing in combustible material and to minimize the hazard from fires in other structures."

Air Filters

Requirements relating to air filters in air conditioning systems have been expanded and somewhat revised. The following paragraphs (151, 153, 155) constitute additions to the old regulations:

"(a) Air filters shall be of the type that will not burn freely or emit large volume of smoke or other objectionable products of combustion when attacked by flames.

"Note: The smoke producing characteristics of the filter should be considered in relation to the occupancy of the building in which it is installed, the kind, nature and air handling capacity of the installation, and whether or not the installation is of the central station or unit type and to the protective features if and when provided.

"The discharge of smoke is particularly serious as a panic hazard in buildings which may be occupied by large numbers of people, such as theatres, auditoriums, department stores, etc. It is also serious in occupancies which contain stock particularly susceptible to smoke damage.

"(b) The installation of approved automatic extinguishing equipment employing water, gas or other approved means in the enclosure of the air conditioning system to protect against combustion of material that may accumulate is recommended for systems other than those of the unit or cabinet type with blower capacity not exceeding 20,000 cu. ft. per min. and which supply only one floor area or a portion thereof. Where sprinklers are installed, suitable provision should be made for drainage. In buildings not equipped with automatic sprinklers, the water supply may be taken from the house piping, if the supply is adequate for the purpose.

"Liquid adhesive tanks into which removable filters are dipped should preferably be located outside the building or in a separate fire-resistive room. Such tanks shall be of metal, equipped with tight-fitting covers and shall be kept tightly covered when not in actual use.

"All air filters shall be kept free of excess dust and combustible material. Unit filters shall be renewed or cleaned when the resistance to air flow has increased to five times the original resistance or when it has reached a maximum of 0.5-in. water gage, whichever is higher. A suitable draft gage should be provided for the purpose. Draft gages, of a type which will operate a warning light or produce an audible signal when excessive dust loads have accumulated, are recommended. If the filters are of the automatic liquid adhesive type, sludge shall be regularly removed from the liquid adhesive reservoir."

Controls and Indicators

The following paragraph (173) has been added:

"In systems installed in buildings equipped with automatic sprinklers or manual or automatic fire alarm systems, it is recommended that the necessary devices and connections be installed to automatically shut down the fans when the sprinkler or fire alarm systems operate."

At the close of Part I of the regulations, a note has been added to the regulations stating that in certain occupancies there is a potential panic and smoke damage hazard, consequently the Underwriters recommend that consideration be given to the development and application of smoke detectors which will automatically shut down the system and set off an alarm signal.

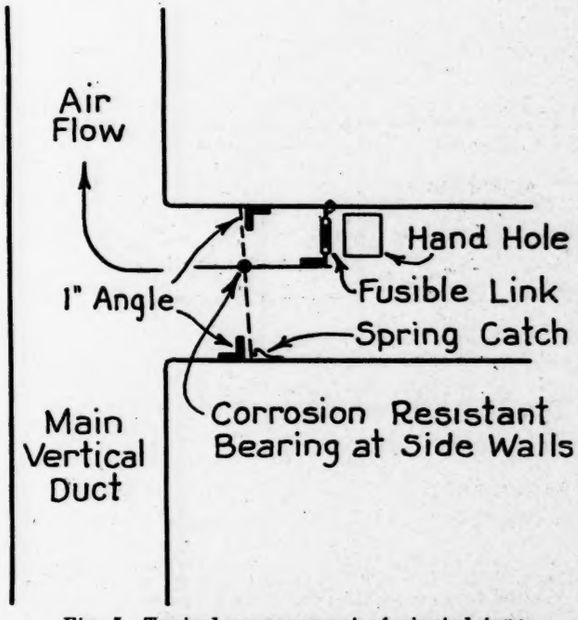


Fig. 5. Typical arrangement of pivoted type automatic damper.

Refrigeration

One of the paragraphs relating to air cooling equipment in the old regulations has been superseded by a new paragraph (191) which states that Mechanical Refrigeration shall be installed with the Safety Code for Mechanical Refrigeration (ASA—B9—1939).

Maintenance

Applying principally to systems covered by Part I regulations, an appendix on Maintenance has been added to the regulations. This appendix is reprinted in full as follows:

"Failure to maintain proper conditions of cleanliness in air duct systems and carelessness in connection with repair operations have been important contributing causes of several fires which have involved air conditioning systems.

"The following recommendations apply, in general, to the period of operation of the system; systems operated only part of the year should be given a thorough general check-up before starting operation and again after shutting down.

"*1. Fresh Air Intakes.* (a) Conditions outside the fresh air intake should be examined at the time of inspection of the ducts. Items to be noted are, (1) Accumulations of combustible material near the intake, (2) Presence of buildings or structures which may present an exposure to the intake allowing smoke and fire to be drawn in, (3) Operating condition of any automatic damper designed to protect the opening against exposure fire.

"(b) If accumulations of combustible material are noted, they should be immediately removed, and arrangements made to avoid such accumulations. Inspections should thereafter be made more frequently. If newly erected exposures are noticed, consideration should be given to the protection at the intake to see that it is adequate. (See Regulations, paragraph 136.)

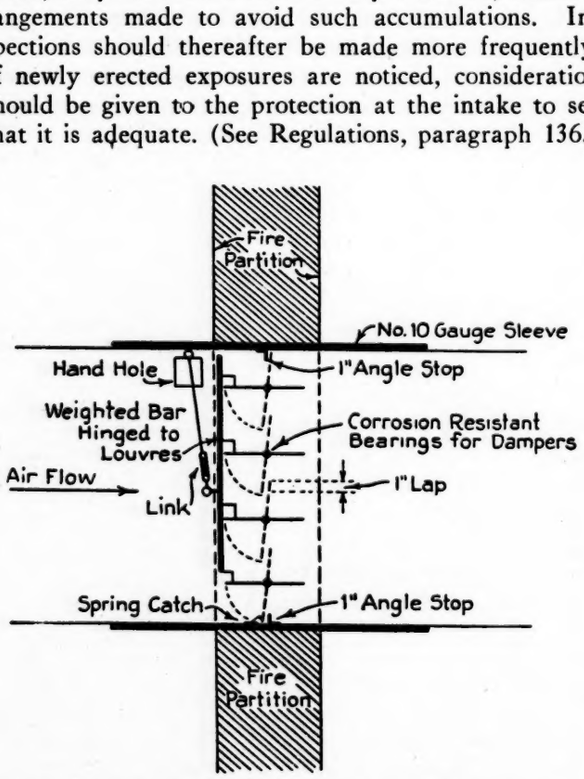


Fig. 6. Typical arrangement of louvered type automatic damper. This type may be used at a fresh air intake, in fire partitions, or at the junction of a branch with a main vertical duct.

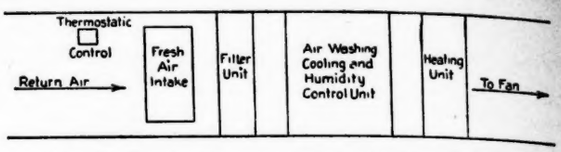


Fig. 7. Typical arrangement of filter, heating, cooling and other units.

"*2. Inspection and Cleaning of Ducts.* (a) Inspections to determine the amount of dust and waste material in the ducts (both discharge and return) should be made quarterly, except that if after several inspections such frequent inspection is found unnecessary, the interval between inspections may be adjusted to suit the conditions.

"(b) Cleaning should be undertaken whenever inspection indicates the need.

"(c) Cooling and heating coils should be cleaned, if necessary, at the time of cleaning the ducts.

"NOTE: Thorough cleaning of ducts may require scraping, brushing, or other positive means. Vacuum cleaning may not remove dust of an oily or sticky nature, or heavy accumulations in the elbows or seams. The amount and kind of dust and dirt will depend greatly on the occupancy and the arrangement of duct system.

"*3. Inspection and Cleaning of Plenum Chambers.* (a) Plenum chambers should be inspected monthly, except that if after several inspections such frequent inspection is found unnecessary, the interval between inspections may be adjusted to suit the conditions.

"(b) Cleaning should be undertaken whenever inspection indicates the need. Where plenum chambers are found used for storage, arrangements should be made to prevent this, such as keeping the doors locked. (See Regulations, Rule 125.)

"*4. Filters.* (a) Unit filters should be renewed or cleaned when the resistance to air flow has increased to five times the original resistance or when it has reached a maximum of 0.5 inches water gauge, whichever is higher. A suitable draft gauge should be provided for the purpose. Draft gauges, of a type which will operate a warning light or produce an audible signal when excessive dust loads have accumulated, are recommended.

"*(b) Filters, intended to be thrown away, after use, should never be cleaned and reused.* (c) Care should be exercised in the use of liquid adhesives. Use of an adhesive of low flash point would create a serious hazard. (See Regulations, Rule 152.)

"(d) Electrical equipment of automatic filters should be inspected monthly, observing the operation cycle to see that the motor, relays and other controls function as intended. Drive motors and gear reductions should be inspected at least semi-annually, and lubricated when necessary.

"*5. Fans, Fan Motors and Controls.* (a) Fans and fan motors should be inspected at least quarterly, and cleaned and lubricated when necessary. Care should be exercised in lubricating fans to avoid allowing oil to run onto the fan blades. Fans should also be checked for alignment, and to see that they are running freely.

"(b) Automatic fan controls should be examined at least once a year to see that they are in operable condition.

"*6. Fire Doors and Fire Dampers.* Each fire door and fire damper should be examined once a year, giving attention to hinges and other moving parts, to see that it is in good operable condition.

"*7. Repair Work.* Great caution should be exercised in the use of open flames or spark emitting devices, inside of ducts or plenum chambers, or near air intakes. (See Regulations, Rule 114A.)

"*8. Inspection Form.* The use of an inspection form to assist in obtaining a thorough inspection is recommended. The form should be made up to fit the system or systems involved, listing the items needing attention."

Piping Changes Eliminate Freezing of Isolated Radiator

IN Fig. 1 is shown the arrangement of a steam radiator in a private garage which caused considerable trouble and eventually froze during a severe cold spell, cracked and had to be replaced.

A considerable quantity of water would leave the boiler from time to time, the owner explained, and after adding fresh water, he would find later that the water had returned to the boiler and had to be drained out.

The 1¼-in. steam line to the radiator was taken from the top of the steam main in the main building, run up through a furred space in the rear wall, and pitched downward toward the garage—in the direction of the steam flow, where it dropped vertically to the radiator valves as shown. When the radiator was closed, during a severe cold spell, the condensation froze and cracked the valve, vertical pipe and radiator.

Careful measurements showed that the outlet of the radiator was only 9½ in. above the normal water line of the boiler. Where the radiator valve was closed the steam condensed and created a vacuum in the radiator. As the radiator was equipped with a non-return vacuum air valve, no air could enter to break the vacuum with the result that water was drawn into the radiator through the wet return.

The simplest method to eliminate the trouble would be to use a wall type radiator, suspend it from the ceiling beams overhead, and connect it with a single pipe so arranged that the condensation will drain back against the steam flow thus eliminating all danger of freezing at any time whether the valve be open or closed. The main objection to this scheme, however, is that most of the heat given off by the radiator will pocket under the ceiling where it does the least good, especially in a case like the present one where no ceiling had been provided under the roof of the garage.

Another method, the one which was adopted in the case, is that shown in Fig. 2. A wall type radiator was furnished and hung on the side wall of the garage. The steam line from the main building is pitched downward toward the garage, then drops down vertically inside the garage and connects with the wet return line underneath the garage floor as shown. A tee is placed in the vertical line with the outlet 42 in. above the water line and the radiator valve was connected to this tee.

With the piping arranged as shown in Fig. 2 there is no danger of the garage radiator freezing when the radiator valve is closed, since no water can be forced into it from the return line when the steam contained in the radiator condenses.

The drop leg, from the tee to the elbow beneath the garage floor, was covered with asbestos and hair-felt with a layer of canvas sewed on over all. This was done to guard against freezing of the water which stands in the vertical pipe.

Shut-off valves were placed on the steam and return lines, inside the main building, so that the garage system could be cut off entirely from the main building and drained free of condensation through a ½-in. drain valve in the return line.

The changes, as outlined, were made a number of years ago and the system has operated satisfactorily ever since. A steady water line is maintained at the boiler at all times.—*W. F. Fischer*

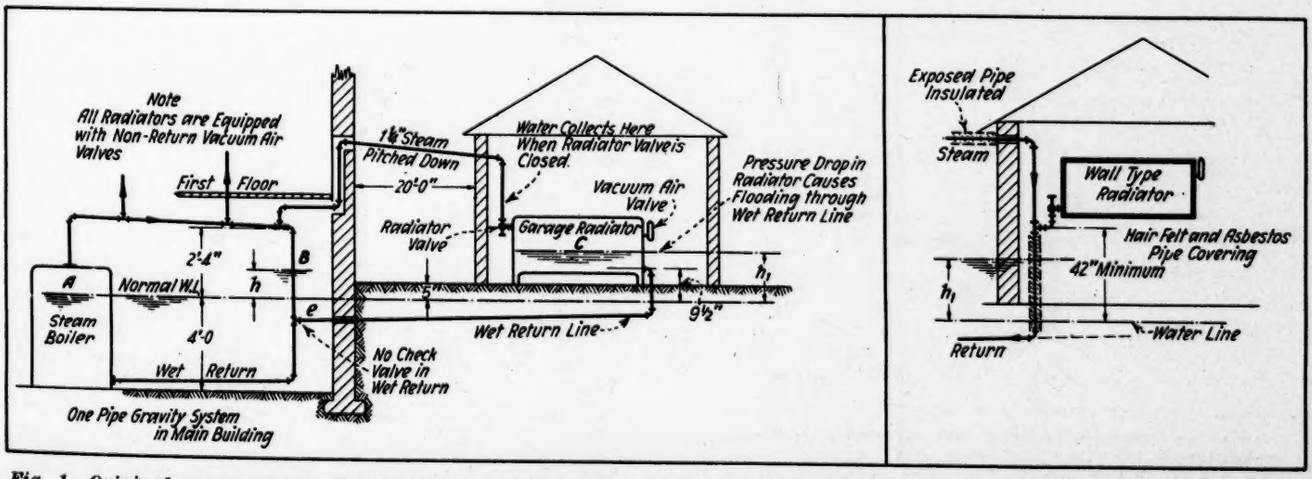


Fig. 1. Original arrangement of radiator in garage which caused considerable trouble and eventually froze during a cold spell. Fig. 2 (right) Piping connections which eliminate danger of freezing and resulted in satisfactory operation.

Detroit Drafts Air Conditioning Code to Assure Safe Operation

The accompanying article outlines the important features contained in the proposed City of Detroit's amendment to its building Code covering the installation of air conditioning systems. The purpose of this amendment is to establish minimum standards of installation to provide for structural safety and fire prevention.

THERE has been, during the past five years, a marked tendency on the part of municipalities to pass ordinances relating to the design and installation, or both, of heating and air conditioning systems. For example, Ft. Wayne has a comprehensive code covering warm air furnaces; Chicago has a code dealing with, among other points, air conditioning design; and Minneapolis has an unusually complete heating code covering all types of heating systems, including some relating to year-round plants. In most of these cases the motive apparently is to assure the buyer a well-designed and economically-operating plant.

The City of Detroit has now drafted an amendment to its Building Code to cover air conditioning systems in buildings other than residences.[1] This code does not attempt to influence the *capacity* of the plant, nor is it concerned with health or sanitation; its purpose is to establish minimum standards in construction and installation considered necessary from the standpoint of structural safety and prevention of fire hazards.

Detroit's new amendment is at the present time (early in August) in a tentative form. Since the original draft a number of meetings have been held in which representatives of various groups have participated. The amendment now is believed to be a form very close to its final form and is expected to be submitted for adoption to the City Council in the near future. The Code was drawn up by the Department of Buildings under the direction of George F. Emery, Chief Building Inspector of the Bureau of Buildings.

The first half of the proposed amendment enforces generally the regulations of the NBFU as outlined on the previous pages.[2] For example, the paragraph relating to the materials in duct systems is essentially the same as the corresponding paragraph of the NBFU regulations. Similarly, the paragraphs on duct linings and flexible connections are similar to those of the NBFU regulations, except that, as generally obtains throughout Detroit's amendment, the amendments are written in ordinance form.

Duct Fabrication and Installation

Detroit calls for some specific type of construction on ducts. The paragraphs covering this follow:

"2903.2 Fabrication. Metallic ductwork shall be fabricated with a Pittsburg Lock on all seams, and all joints between sections shall be connected with 'S' and drive cleats. Other methods or types of fabricating and connecting metallic ductwork except soldering or brazing may be used providing they will produce connections as tight and sound as those specified. Metallic ducts and fittings may have welded seams, provided straight ducts are welded at least every one and one-half (1½) inches on center, and fittings every one (1) inch on center; and all overlaps so welded shall have at least a one-half (½) inch lap.

"When 'S' joints are used in fabricating ductwork in lieu of locked or welded seams, either in plenum, main trunk, branches or any ductwork, they must also be connected with a button punch, weld, screw, rivet or bolt at least every fifteen (15) inches on center, and the first such connection must not be more than three (3) inches from any end joint. On all fittings so jointed and connected, the button punch connection, weld, screw, rivet, or bolt shall be at least every four (4) inches on center."

Other paragraphs which essentially follow the NBFU code are those relating to plenum chambers, access doors, oil filters, duct support, duct location, fire stopping, inlets and outlets, and fire doors. In the NBFU regulations suggested forms of fire doors are shown in drawings, whereas in the Detroit ordinance this information is presented in written form.

The following provision for heating coils is found only in the Detroit ordinance.

"2903.12 Heating Coils. The steam pressure in the heating coils of any air conditioning system shall be limited to 15 pounds per square inch, and shall be protected with an A.S.M.E. safety valve. Steam and hot water apparatus in air conditioning systems shall be installed in accordance with Section 2208 of this Code."

Refrigeration pipe inside of ducts is provided for as follows:

"2904.9 Material Inside of Ducts. Refrigeration pipes exceeding one (1) inch in internal diameter, gas pipes, oil lines and steam pipes not protected with A.S.M.E. safety valve to limit the pressure to 15 pounds per square inch in the pipes shall not be installed in any ductwork except in the plenum chamber."

Duct clearance is provided for by Detroit as follows:

"2904.5 Clearance. Metallic duct systems shall not be placed or installed within two (2) inches of combustible construction or material including plaster on wood lath unless all such combustible construction or material within two (2) inches of the duct system is protected with a continuous layer of one-quarter (¼) inch asbestos or equivalent incombustible material."

Requirements relating to vertical ducts in the Detroit amendment have no corresponding paragraphs in the NBFU regulations. They are reprinted here as follows:

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[1] A previous amendment covering mechanical warm air heating systems has been in effect since February 3, 1938.

[2] See HEATING & VENTILATING, July, 1937, pages 53 to 58 and the article in this issue (September, 1939), Fire Underwriters Revised Regulations on Air Conditioning Installations.

"The openings in floors of a building provided for or caused by the passage of ducts or shafts through these floors in connection with the installation of a new duct system, or addition to an existing duct system, shall be protected by enclosures as hereinafter specified throughout the basements or stories into which such ducts or shafts pass.

"2905.1 New Buildings. In new buildings the materials and methods of construction of these enclosures, where enclosures are required herein, shall conform to the requirements specified for enclosure of vertical openings established under the specifications for the type of construction required under this Code for the particular building involved.

"2905.2 Existing Buildings. In existing buildings, these enclosures, where required herein, shall be built of materials and method of construction equivalent and not inferior in fire resistive qualities to the materials and method of construction on the enclosures of the existing stairways, elevators, dumb-waiters and other vertical openings of that building, provided, that where all existing vertical openings are not enclosed with incombustible enclosures in an existing building, the enclosure of vertical openings caused by installation of a duct system shall not be required in that building.

"2905.3 Class A and C Buildings.[3] In Class A and C buildings, all vertical ducts passing through two or more floors, or into three or more stories, shall be enclosed as hereinbefore specified, provided, that in two-story and basement or cellar buildings, such enclosure may be omitted. Where sub-basements are used all ducts entering same shall be enclosed throughout all basements or stories into which such ducts pass.

"2905.4 Class B Buildings. In Class B buildings, all vertical ducts passing through any floor including basement floors or into two or more stories shall be enclosed as hereinbefore specified.

"2905.5 Class D Buildings. In Class D buildings, all vertical ducts passing through basement or first floor or into sub-basement or basement shall be enclosed as specified hereinbefore.

"2905.6 Class E Buildings. In Class E buildings exceeding two stories in height, all vertical ducts shall be enclosed as hereinbefore specified."

Fire Dampers

A damper is called for in the Detroit amendment to be provided at the supply duct end of each plenum chamber containing an evaporator of a direct refrigeration system containing more than 50 lb. of a group 1 refrigerant as defined under the official Refrigeration Code of the City of Detroit.

A fire damper is to be provided at each point where a duct enters or leaves the enclosure of a vertical duct, and one is to be provided "in each return duct of all air conditioning systems at the point where it joins the plenum chamber, and/or at each return opening to the plenum chamber. Where return air and fresh air ducts join before entering the plenum chamber a fire damper shall be provided in the main return air duct at a point between its junction with the fresh air intake duct and the inlet nearest to the fresh air intake duct."

Complete specifications are given for the construction of fire dampers and the Code is quite specific regarding their installation. The paragraph relating to the installation of fire dampers is as follows:

"2906.6 Installation of Fire Dampers. All single blade fire dampers in horizontal ducts shall be arranged to close in the normal direction of the air flow. All single blade fire dampers in horizontal ducts shall be hinged at one edge so as to close by gravity and the hinges shall be placed at the top edge of the damper. Single blade fire dampers in vertical ducts shall be either hinged at one edge, or pivoted on a horizontal shaft. When a pivoted type of fire damper is used, a substantial steel shaft shall be provided rigidly attached to the damper and supported on bearings secured to duct walls on both sides. Both the hinged and pivoted type dampers shall be provided with sufficient counterweight to close the dampers under all conditions whenever their fusible links shall be melted. All fire dampers not automatically controlled by damper motors shall be held in the open position by means of fusible links placed inside of the duct system which will melt at a temperature of 125F or lower, when placed in the return ducts and 200F or lower when placed in the supply ducts or supply duct end of the plenum chamber, and shall be arranged so as to close by gravity when the fusible link holding the damper is melted. All automatically controlled fire dampers in the return ducts shall close when the temperature of the air in the duct at the damper location reaches 125F or less, and in the supply duct or supply duct end of the plenum chamber when the temperature of the air at the damper locations reaches 200F or less. All automatically controlled fire dampers shall have a normally closed position, to which the dampers shall be returned either by a spring or weighted counterbalance in case of electric current or motor failure. All such springs shall be securely installed outside of the duct. The force exerted by the spring or counterbalance shall be sufficient to close the damper and the counterbalance shall be sufficient to hold the damper securely closed unless a suitable catch is provided. An automatic catch shall be provided to hold all fire dampers, depending on a spring to close them, in the closed position. All damper frames shall be secured to all walls of duct and all space between the frame of the dampers and the edge of the duct shall be tightly caulked with either plastic cement or an asbestos fibre gasket."

Protective Devices

A blower switch is required for all air conditioning installations; every system with a direct heater must

[3]The Detroit Building Code classifies buildings approximately as follows: Class A-1—Manufacturing buildings, warehouses, lofts, laundries, power houses, etc.; Class A-2—Semi-public buildings such as stores, office buildings, pool and bowling halls, restaurants, comfort stations, and places of assembly for not over 100 persons, such as dance halls, auditoriums and private schools, etc.; Class B-1—Garages, service stations, paint shops and other buildings subject to unusual fire risks, except as covered by Classes B-2 and B-3; Class B-2—Dry cleaning establishments and buildings used for the storage or manufacture of celluloid, films, varnishes, lacquers, explosives and acetylene; Class C—Public buildings such as city or county court houses, city halls, libraries, museums, passenger stations, armories, etc., but not including theaters; Class D—Theaters and moving picture houses; Class E-1—Multiple dwellings for 3 or more families, including hotels, etc.; Class E-2—Hospitals and homes for aged, etc.; Class E-3—Prisons, jails and asylums, etc.; Class F—Single and two-family houses, etc., with not over 10 sleeping rooms; Class G—Miscellaneous structures.

have a limit control in the plenum chamber between the direct heater and the supply duct. A blower shut-off is required in certain types of installations and a smoke detector is required in certain installations as follows:

"2907.4 Smoke Detector. Every new air conditioning system supplying air to buildings of Classes C, D, E-1 buildings for more than ten (10) families or containing more than 25 sleeping rooms, and E-2 buildings providing more than 25 beds for patients, and those buildings of Class A as specified hereinbefore in Section 2903.10 shall be provided with an approved smoke detector. Existing air conditioning systems in all buildings of Class D, air conditioning systems supplying air to auditoriums having a seating capacity of more than 1000 persons in Class C buildings, and air conditioning systems supplying air to any floor other than the first, and any basement of Class A buildings occupied as restaurants, public establishments, retail stores, recreations, business colleges, telephone exchanges, markets, arcades, dance halls, auditoriums, meeting rooms, or private schools, and in which the floor area of such occupancy exceeds 10,000 square feet on any one floor between fire walls, shall be provided with an approved smoke detector as herein specified.

Maintenance

Many of the provisions in Detroit's new amendment were set up specifically to prevent such accidents as occurred a year ago when fire and smoke from rubbish in the return ducts in one of the city's large department stores caused considerable damage. Consequently, it is not surprising to find the following provisions in the amendment:

"2908.1 Maintenance. All air conditioning, ventilating, and exhaust systems shall be properly maintained at all times and all ducts and plenum chambers shall be kept free of excessive dust and accumulation of combustible rubbish or debris. Plenum chambers shall not be used for storage or occupational purposes.

"2908.2 Cleaning. Plenum chambers and ducts shall be examined periodically and accumulations of dust, rubbish, or other debris shall be removed so as to maintain the duct system in a reasonably clean condition. All filters shall be kept free of excess dust and combustible materials and shall be cleaned or replaced periodically so as to maintain this condition."

Permits and Licenses

In the future, Detroit will apparently provide that no new conditioning system can be installed or additions made to an existing system if more than 50 lbs. of a group 1 refrigerant are contained in a direct refrigerating system evaporators, unless an installation permit has been obtained.

Furthermore, no permit will be issued for the installation of a new conditioning system or the alteration of an existing system, except to an air conditioning contractor, licensed as such under this Code, with the exception that the owner of a building can have such work done by his employees.

For an air conditioning contractor to obtain a license to install or alter air conditioning systems, a license fee of $25 is required, together with a bond of $5000. The license will expire December 31st of the year in which it is issued.

Definitions

The definition of an air conditioning system is rather an unusual one as follows:

"2902.1 *Air Conditioning System* shall mean a duct system employing mechanical means for supplying, to the whole or any part of a building, re-circulated air, to which may be added fresh air, and which may be conditioned either by heating, cooling, cleaning, deodorizing, humidifying, dehumidifying, placing in motion or a combination of these or any other treatments."

Throughout the Code the word approved means "tested and listed, for the purpose required herein, by the Underwriters' Laboratories, Inc., or by such other testing laboratory as may be accepted by the Board of Rules, and bearing a label or certification of inspection and approval by that laboratory."

Man-Made Dust Storm Grades Soil Particles

WHEN duststorms of 1934 and 1936 darkened the sky from the Southwest to the Atlantic Ocean, the grit that settled at Cincinnati was finer than the particles dropped at Kansas City, and dust deposits at Washington, New York, and Boston were progressively finer. A modification of what happens in a "duster" is the basis of a new device for grading soil particles developed in the Soil Conservation Service laboratory at the California Institute of Technology.

When the laboratory staff needed soil particles sorted accurately according to size, they developed a simple machine that creates a gentle "duster." The machine drops assorted sizes of sand or silt particles in suitable drawers, the coarser bits nearest the feeding hopper, the finer particles at a distance. For the most accurate sorting they run the dried sand or silt through twice.

The sorting machine is a bell-mouthed wind tunnel about 15 feet long with a grating as a floor to let the sorted material drop into the collecting drawers below. A small electric fan draws air through the tunnel at not more than 2½ feet a second.

Dry sand and silt is fed in a thin sheet from a hopper on top of the tunnel. Larger particles drop almost vertically. The finer the sand or silt particles, the farther they are carried by the breeze. Particles of equal size drop at equal distances from the feeding apparatus. Walls of the tunnel are made as smooth as possible to prevent eddies, but there is some difference in the air action near the walls, so the drawers have partitions at each end, and this material is rejected. What drops in the central compartment is graded more accurately than is possible with fine sieves. The machine will handle from 60 to 100 pounds an hour.

Air Cooling for Oil Field Buildings in Tropical Climates

By O. W. JOHNSON† and T. A. POLLARD‡

Air conditioning of residence quarters in the tropics is not yet common. Here and there cooling is being put in and the early installations are the result of much study. The problems encountered, the methods used, and the operating results obtained are of general interest for these early installations can do much to help or hinder the adoption of cooling in the tropics. This article is from a paper which was presented by the authors at the 1939 meeting of the American Institute of Mining and Metallurgical Engineers.

AIR conditioning, as applied to tropical regions, is usually confined to the summer season, and consists essentially of maintaining rooms or buildings continuously below outdoor temperatures, usually with some attempt at the control of humidity.

Such a situation presented itself when last year it was proposed that conditioning be provided for a group of fifteen duplex cottages for married couples on the island of Bahrein in the Persian Gulf. Although the problem as actually presented here is hypothetical, the solutions follow closely the steps actually taken in providing air conditioning in a group of buildings similar to those described. The conclusions drawn are valid for the conditions and limitations stated but should not be applied to other problems without careful consideration, since apparently minor differences in conditions can sometimes greatly alter the overall aspect of the situation.

Each half of the duplex houses consisted of a three-room suite of living room, bedroom and kitchen. The houses were to be spread out along the brow of a low hill, oriented in varying directions to conform to the topography, and with a minimum spacing of fifty feet. Although arranged roughly in two rows, the group occupied considerably more space than would a similar group of houses in a suburban area. This comparatively wide spacing required special consideration in the final design of the equipment.

The floor plan of the house was arrived at after a lengthy consideration of the minimum requirements in area and equipment, taking account of the fact that the house was to be artificially cooled. The external appearance of the house is indicated by Fig. 1. This picture reveals the general style of the building, including the shade used to keep the sun's rays off walls and windows during the middle of the day. The arrangement and size of the rooms is indicated on the sketch Fig. 2.

Choice of the type of construction to be employed was made after a consideration of the cost of imported and local materials, availability of local native artisans, etc. It was finally decided to employ walls of native stone, with flat roofs supported on wood joists. Floors were of concrete placed directly on an earth fill. Preliminary computations indicated that insulation of both walls and ceiling would be warranted. Accordingly, plans were made to install 2 in. of rockwool insulation in the walls wherever possible, and to provide 3½ in. of rockwool insulation between the ceiling joists under the roof.

†Standard Oil Co. of California, San Francisco.
‡The Bahrein Petroleum Co. Ltd., New York.

Computation of Load

The first step in the problem was to make a preliminary estimate of total heat gain. This required a choice of design conditions for both indoor temperature and outdoor weather. The location of the camp was about 26° north latitude, and the rather incomplete weather records available indicated that outdoor temperatures of 100F or over would prevail practically every day during the worst season, and that the moisture content would probably range around 0.021 lb. per pound of dry air—equivalent to 79F dew point. This condition was accordingly chosen for an outdoor design condition. For an indoor design condition, a preliminary figure of 85F and 50% relative humidity was chosen, corresponding to a dew point of 65F (absolute humidity 0.013 lb.).

In considering the justification for air conditioning, it had previously been decided that it would not be necessary to cool the kitchens. The heat liberated by the electric refrigerators, cooking stoves, etc., makes the cooling of such a room difficult, and it was felt that the extra expense of cooling this room, which would be occupied but a few hours a day during the hot weather, was not warranted.

Based on these assumptions, the total cooling load for one half of the house was computed to be 17,450 B.t.u. per hr. This is made up of 7700 B.t.u. of structural load; 1600 B.t.u. from lights, fans, etc.; 3150 B.t.u. given off by an estimated six occupants; and 5000 B.t.u. to cool 90 cu. ft. per minute of air from the outside temperature down to room conditions, to provide ventilation.

The load thus amounts to nearly 1½ tons of refrigeration and would be expected to require an expenditure of the order of 1½ hp. The total load for the group of fifteen houses would amount to 45 tons net.

Type of Equipment

At this stage it became necessary to decide on the general type of equipment to be employed. It will be impossible to review here all of the factors which were considered and evaluated in arriving at a decision in this matter. Among the more important steps in the process were the following:

Fig. 1. View of cottage on Bahrein Island of the type for which air cooling is provided.

(1) It seemed desirable to have equipment installed in the houses as simple as possible, in order to minimize the problem of maintenance. This indicated the desirability of having a central refrigerating plant, with some means of distributing the *cooling* to the various houses.

(2) The wide separation of the houses made it seem undesirable to attempt to distribute liquid refrigerant to each house from a central point. The only alternative, therefore, appeared to be to use chilled water, at a temperature of around 50F, and this system was finally adopted. Orifices of varying sizes were specified for the house branch lines, in order to obtain a uniform distribution of chilled water. It was found uneconomical to provide insulation for the pipes, other than to lay the supply and return lines close together, buried to a minimum depth of two feet.

(3) A single cooling unit for each half of each house was considered preferable to either one unit for the whole house, or separate units for each room. With the former arrangement each householder has control of the operation of his own unit, and can, at his option, direct all of the cooling either into one room or the other.

(4) Although fairly reliable native help was available, no technicians skilled in erecting or operating refrigerating machinery were available. This fact emphasized the necessity for making all equipment as simple as possible, avoiding particularly complicated controls, or other similar features which could possibly be dispensed with.

(5) Electric power from a reliable source was available, and no plant additions would be necessary to carry the anticipated load. This indicated the desirability of electric drive for the central plant, particularly since the operation would be thus greatly simplified.

(6) The cost of water would not permit running condensing water to waste, so it was decided to install a cooling tower. On the basis of unsatisfactory experience with natural draft towers, which lose capacity during periods of calm, which are frequent in this region, it was decided to employ a forced draft tower. Arrangement was made to provide continuous blowdown for the tower, to prevent salts in the extremely hard make-up water from building up to a point where solids would deposit.

Central Plant

As finally laid out, the central plant comprised two separate and independent refrigerating machines, each with its own water-cooled condenser and water chilling evaporator, a cooling tower, and condensing water and chilled water circulating pumps. Hermetically sealed electrically driven compressors were chosen to minimize refrigerant leaks, and F12 was used as the refrigerant. Both condensers and evaporators were made with straight tubes and removable heads, to permit cleaning the water side, and steel was employed to avoid the possibility that unskilled labor might damage the softer non-ferrous metals. The dual arrangement permits operating at part capacity in case one half of the plant should break down; this was considered to be sufficient assurance of continuity of operation, so that no standby equipment was provided. Automatic controls (other than safety devices) were avoided in the interest of simplicity, and because the load does not fluctuate rapidly, making manual control satisfactory.

A chilled water temperature of 50F was chosen as offering the best compromise, taking into consideration the capacity of the compressors, heat gains in the buried pipes, and the performance of the cooling units. On this basis the heat pick-up in the buried chilled water pipes was computed to be a little over five tons of refrigeration. Although this loss could be cut down by insulating the pipes, it was established that the cost of additional insulation would far exceed the value of the capacity thus saved.

Specification of Cooling Units

For the air cooling units to be located in each half of the house, it was decided to employ a water coil unit having a motor driven centrifugal blower, to deliver about 600 cu. ft. of cooled air per minute. Filters were provided to remove dust and lint from the air before it was passed over the water coil. The chilling unit was located in a small closet adjacent to the hall, as indicated on the plan. A small fresh air inlet extending through the ceiling and well above the roof provided a means for drawing in the required amount of fresh air, while a grille in the closet door permitted a somewhat larger quantity of room air to be drawn into the unit for re-circulation. The cooled air was delivered

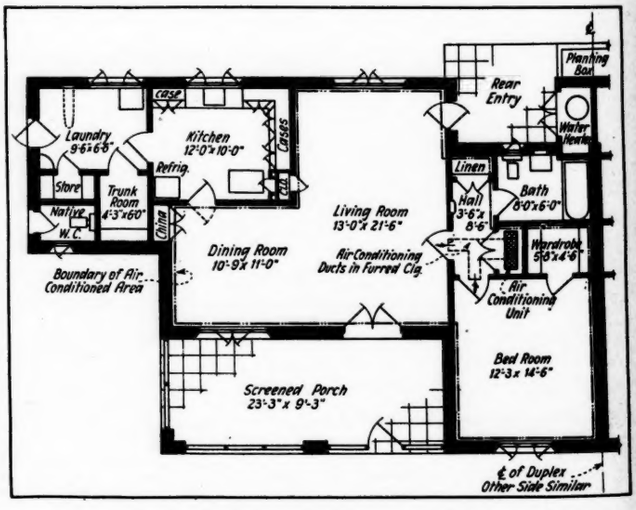


Fig. 2. Floor plan of half of Duplex Cottage showing location of conditioning unit and ducts.

through ducts enclosed above the hall ceiling, to outlet grilles located in the bedrooms and living rooms, where dampers were provided to permit altering the air distribution as required.

On the basis of the previously computed cooling load, a specification for a cooling unit was prepared, the essential requirements of which were as follows:

General: **Unit to consist of a water coil, centrifugal blower, drip pan, and filter holder, mounted in a substantial metal case, and arranged to deliver the cooled air vertically upward. The coil is to be supplied with chilled water at a temperature of 52F and the air flow through the coil is to be downward to facilitate removal of condensed moisture.**

> *Note:* **The 52F water temperature is 2F above that chosen for the temperature of the chilled water leaving the central plant. This generous allowance was made to cover any temperature pick-up in the buried lines, and as a factor of safety.**

Capacity: **With air entering the unit consisting of a mixture of 90 c.f.m. of outside air at a temperature of 100F dry bulb and 84F wet bulb, plus the required quantity of recirculated room air at 85F dry bulb and 71F wet bulb, the total heat removed shall be 17,450 B.t.u. per hr. of which 5760 B.t.u. per hr. shall be latent heat.**

In response to the above inquiry, a unit having a 7½ in. x 30 in. 4-row down-draft water coil was offered. This unit had a rating, based on 600 c.f.m. of mixed air entering the coil, and 5½ gal. per min. of 52F water, of 17,500 B.t.u. total, but the latent capacity under these conditions was only 4890 B.t.u.

To avoid a too high indoor humidity, it was necessary to increase the latent heat capacity of the unit. It was found that about six gal. per min. of 51F water would give the required latent capacity (5760 B.t.u.) with a total heat capacity of 18,100 B.t.u. Since it was felt that a 51F water temperature would probably be actually obtained, it was finally decided to proceed on this basis. The increased total capacity of the unit under these conditions would result in a room temperature of around 83F instead of the original design temperature of 85F.

Fig. 3. Typical central air conditioning plant.

Installation and Operating Precautions

In order to insure reliable and continuous service under the conditions peculiar to this installation, certain provisions not ordinarily encountered in similar jobs were made.

Control: Thermostatic control equipment is sometimes a source of trouble and maintenance expense. Also, it was believed that most units would operate at full capacity during a greater portion of the time. Hence, to save the cost of the controls, and to avoid unnecessary maintenance, no automatic controls whatsoever were installed in the individual houses. The occupants do, however, have a measure of control, in that the air quantity delivered to the various rooms can be cut down when desired by closing the registers. It is also possible by this same means to vary the distribution of the air between rooms as desired. Experience has shown this arrangement to be entirely satisfactory.

Fresh Air Supply: As previously pointed out, the heat which must be removed from the outside air brought into the building represents a considerable fraction of the total load. On the other hand, if an adequate supply of fresh air is not provided, a very close and unpleasant indoor condition may result. After a somewhat unsatisfactory experience in houses not equipped with a positive means of introducing outside air, it was decided to provide a fresh air duct leading from the roof into the space where the air conditioning unit was installed. This duct is proportioned to provide the desired quantity of outside air, which mixes with the recirculated room air before passing through the cooling coils. With this arrangement the fresh air is well distributed throughout the house, which is an advantage over the alternative method of allowing fresh air to enter through partially enclosed windows. An additional advantage of introducing fresh air directly into the cooling unit is the improved performance of the coil in the matter of removing moisture, which makes it possible to improve the moisture balance of the whole system. This effect, which is not readily apparent, is discussed in detail in textbooks on the subject.

Filters: It has been found desirable to employ air filters on the air intake of all units. These filters remove household dust and lint and a great proportion

of the outside air-borne dust which enters the house, and which would otherwise strike and cling to the wet surface of the cooling coil. If dirt is allowed to accumulate on the coils, the passage of air is impeded and the capacity of the unit is reduced. It has been found advisable to clean filters regularly about every two or three weeks, and when this is done, the coils remain clean enough to give satisfactory service throughout a whole season.

Supervision: For best results it has been found necessary to exercise fairly complete control over the operation of the units. If this is not done, it is likely that misinformed persons will attempt to make adjustments which may seriously impair the operation. Fresh air intakes have been closed off, the return air grilles have been obstructed by piling luggage or other articles against them, doors or windows may be left open unnecessarily. When the effects of such actions are explained to the occupants, and simple instructions are given, there is usually no difficulty in obtaining the cooperation necessary to produce the best possible conditions.

Conclusions

While it is impossible to present cost figures having any general application, a few rough approximations may be of interest. It has been found that if all costs, including overhead on labor, are taken into account, the total cost of the air conditioning equipment in a building such as described here, including not only the equipment located within the building, but also a pro rata of the cost of the chilled water distributing system, central plant and its appurtenances, and a proportion of the power plant required to furnish operating power, will amount to something of the order of $600 per ton of refrigeration. For a duplex house requiring three tons of refrigeration this means an average expenditure of some $1800 for air conditioning, in addition to the cost of insulating the structure. The cost per house will of course decrease for a larger number of houses, particularly if a somewhat closer spacing should be feasible.

It is believed that the particular type of air conditioning system described here has not been applied before to a group of detached houses spread over as wide an area as actually was done on Bahrein Island. The first season's operation was free from serious trouble. This fact indicates the feasibility of applying the method to future installations, where conditions warrant. Some complaints were made concerning the operation of the system as actually installed. These took the form mainly of insufficient cooling when more than 8 or 10 people were present in the small houses, and inadequate cooling of kitchens. Since neither of the above factors were provided for in the design (because of cost considerations), no fault can be laid to the air conditioning system. In some cases it was felt that the cooling obtained in certain houses was better than that obtained in others. Such differences may be attributed to partial clogging of individual house coils, kinds of drapes used, number of occupants in the houses, and quantities of fresh air admitted in each case. Sleeping conditions were generally conceded to be good, some occupants actually using blankets at night.

Cost of Steam for Air Conditioning Purposes

EVERY air conditioning engineer who uses steam should be familiar with Napier's famous "steam flow rule" since this rule is used as the basis for many computations pertaining to the use of steam. It is applicable to any problem where steam flows directly from high pressure into the atmosphere, as for humidifying, creating draft in furnaces, in soot blowers, heaters, or oil burner atomizers.

This is the rule as applied to steam flowing through a given opening: Multiply the absolute steam pressure by the area of the opening and divide the result by 70. The result is the weight of steam flowing in pounds per second through the opening.

So that the rule can be more readily applied to most actual cases of steam flow it has been converted into the following form:

$$\textit{Cost of Steam, dollars per 10-hr. day} = \frac{0.257\,PAC}{W}$$

Where C = Cost of coal per dollars per ton
P = Absolute pressure, lb. per sq. in.
A = Area of opening, sq. in.
W = Pounds of water evaporated into steam per lb. of coal

Example: What is the cost per 10-hr. day of steam flowing through a ½-in. round opening for creating draft in a furnace where the gage pressure is 100 lb. per sq. in? Fuel costs $4 per ton, and 8½ lb. of water are evaporated into steam per lb. of coal.

The area of the ½-in. round opening is 0.196 sq. in. Then, substituting in the formula it will be found that the cost of the steam is $2.72 per 10-hr. day.

For instances where oil is the fuel, the rule has been converted into the following form:

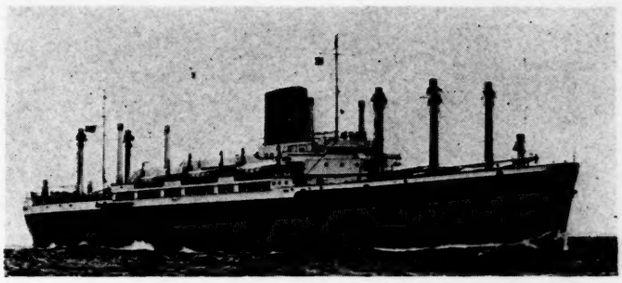
$$\textit{Cost of Steam, dollars per 10-hr. day} = \frac{64.3\,PAO}{Q}$$

Where O = Cost of oil, dollars per gal.
Q = Lb. of water evaporated into steam per lb. of oil

Example: What is the cost per 10-hr. day of steam flowing through a ½-in. round opening in an oil burner where the gage pressure is 100 lb. per sq. in.? Oil costs 5 cents per gal., and 15 lb. of water are evaporated into steam per lb. of oil.

Substituting in the formula as applied to oil combustion we get $4.83 per 10-hr. day as the cost of the steam.—*W. F. Schaphorst.*

Ventilation and Air Conditioning of the S. S. Panama



The new S. S. Panama of the Panama Railroad Steamship Line.

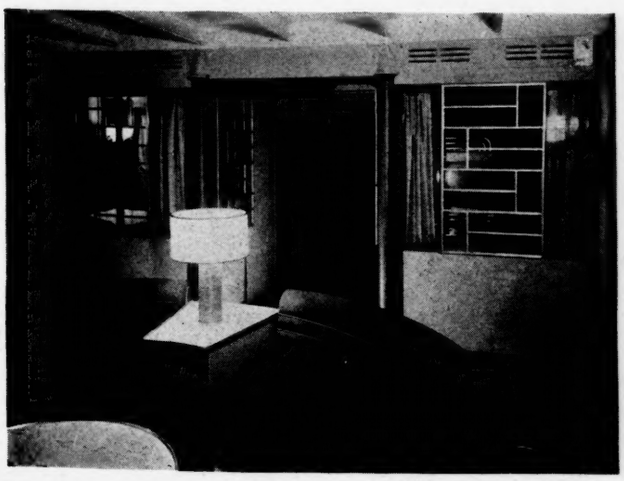
THERE was recently completed at the Fore River Works of the Bethlehem Shipbuilding Company, from plans by George Sharp, naval architect, the first of three handsome liners for the Panama Railroad Steamship Company. This was the S.S. *Panama.* Two sister ships, identical in most, if not all respects, the *Ancon* and the *Christobal,* are now under construction at the same yards, where the keels for four new vessels for the American Export Line have also been laid, and where a huge amount of ship construction for the United States Navy is also under way—the whole totaling around $130,000,000.

The *Panama,* and her sister ships, typify the trend toward better living conditions for the seaman, as well as greater safety for passengers and crew alike. These ships are as near fireproof as possible. They also have air conditioning for part of the vessels, complete ventilation, and air cooled, insulated holds, with a complete refrigeration system for perishable cargo and perishable stores.

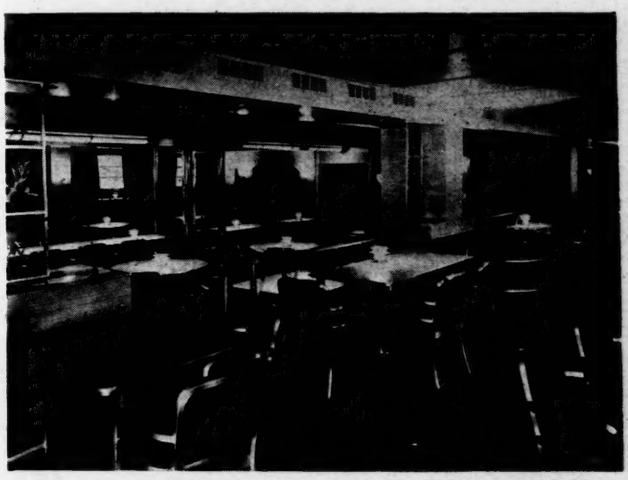
The main dining room and the crew's mess rooms, as well as the inside rooms for the chief steward, purser and stewardesses, are air conditioned. Air conditioners for the main dining room are in two units located at the lower level of the generator room. They are enclosed in insulated compartments and refrigeration is furnished by the main refrigerating plant. Capacity is sufficient to maintain a temperature of 80F in the dining room when the outside air is 95F. Heating coils are provided for maintaining the dining room temperature at 70F when the outside air is at 0F. Messrooms have self-contained units.

The vessel is fitted with a comprehensive ventilation system. All passengers' and crew's accommodations, public spaces, work spaces and storerooms, as well as the machinery spaces, are ventilated mechanically. To provide satisfactory ventilation in passenger and crew accommodations and in the galley, there were installed supply and exhaust systems of equal capacity. Cargo holds, except the refrigerated spaces, are provided with natural ventilation.

Ventilation of passenger and crew accommodations are divided into thirteen systems, each provided with one supply and one exhaust fan, except the system supplying the officers' quarters on the Sun Deck, which has only the supply fan. Each fan is rated at 4800 c.f.m. Fans for each system are installed in thirteen fan rooms, eight of them located on the boat deck, four aft on the promenade deck, and one below the front of the superstructure on A deck. All fan inlets of the systems are louvered openings in the sides of fan rooms and deckhouses, and have filters fitted at the fan inlet.



One of the private verandas for passenger's stateroom. Note the air inlets in the wall just below the ceiling.



The Grand Dining Salon showing the air conditioning ducts and outlets.

Vertical trunks run from the fan rooms to the various spaces to be ventilated. In passenger quarters, twin hot and cold ducts branch to the adjoining spaces. Exhaust ducts lead from the bathrooms to the vertical trunks, a space being provided under the bathroom doors to complete the path of circulation. Simplicity is the keynote of this scheme of ventilation, especially in the portion of "A" deck having staterooms arranged on the veranda system.

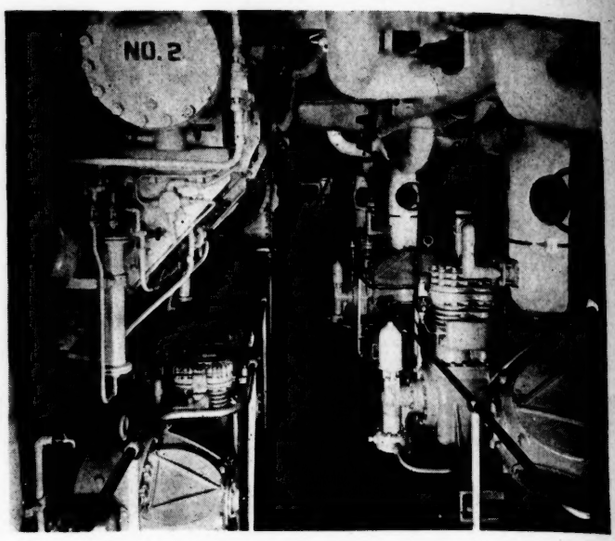
Arrangement of verandas permits simplified mechanical ventilation by means of short branch supply and exhaust ducts from the main vertical ducts. Longitudinal supply ducts are enclosed in the girders. Structural vent ducts at bulkheads are used for ventilating crew quarters.

All heating of passenger and crew quarters is provided by heated air supplied through the ventilating system. A pre-heating coil, capable of raising air temperature from 0 to 50F with steam at five pounds pressure, is located at the inlet of each of the thirteen systems supplying the quarters. Half of the air supplied is then sent through a re-heater coil that is capable of raising the temperature from 50 to 70F in the quarters when the temperature is 0F outside. Air to all compartments is sent through a double duct system, hot or cold, and terminates in specially designed mixing chambers with adjustable dampers from whence it is discharged through grilles into the various compartments. Inlets to the staterooms have individual mixing chambers and are provided with control knobs for adjusting the temperature within a wide range, to suit the passenger.

Galley and pantries are provided with two complete systems of supply and exhaust. Each system has one supply and one exhaust fan of 8700 c.f.m. All exhaust ventilation is discharged clear of the ship.

Machinery spaces are thoroughly ventilated by eight supply fans of 8700 c.f.m., one exhaust of 8700 c.f.m. and two supply fans of 4800 c.f.m. each. Four of the supply fans are located in the engine room and furnish ventilating air to this space as well as to the adjacent workshops and storerooms. Air in the engine rooms is exhausted by natural means, passing up a vent trunk to a point above the bulkhead deck and thence down a horizontal watertight duct across the ceiling of the auxiliary machinery room, where it is discharged into the boiler room. The one exhaust fan serves the workshops and storerooms and in addition takes care of "hot pockets" in the engine room.

Four supply fans, two of 8700 c.f.m., and two of 4800 c.f.m. ventilate the upper and lower levels of the auxiliary machinery room. Air is exhausted naturally from these spaces through the watertight door opening into the boiler room, the door opening being shielded by means of an open topped vestibule. Two supply fans of 8700 c.f.m. each ventilate the boiler room.



Refrigerating machinery room of the S. S. Panama.

All fans except those for the machinery spaces are provided with a master control at the fire control station, which can be used to shut down the fans in case of fire. They are all mounted on special foundations and run at low speed for silent operation.

Refrigerated cargo spaces may be ventilated by fresh air when needed by means of supply fans located in the fan rooms on the upper decks, the fresh air being drawn directly into the diffusers, cooled and then circulated in the usual manner. Foul air is vented from each space by opening a hinged insulated plug in the exhaust trunk which rises through the decks above. Cold diffusers form a complete assembly with fan, motor, cooling coils and casing. Diffusers in cargo spaces where frozen cargo is carried are provided with a brine re-circulating pump, brine sprays and brine tanks for use when the temperature is to be maintained at 0F. The refrigerating system is of such capacity that when all cargo spaces are loaded with bananas at a temperature of 85F the temperature of the delivery air may be reduced to 53F in 24 hours and 40F in 72 hours. Frozen cargo is only carried on southern trips.

Air-Conditioning Extended on Indian Railroads

AIR-CONDITIONED travel was first introduced on Indian railroads in December, 1937, when the Bombay-Calcutta Mail express was equipped. A few months later it was installed on the Frontier Mail running between Bombay and Delhi. Now it has been decided to equip cars on the Delhi-Peshawar and Lahore-Karachi lines. The possibility of providing air-conditioned cars on the Calcutta-Delhi and Bombay-Madras routes is also being considered and these services will probably be the next to be modernized in this manner.

The great advantage of air-conditioned travel in India is not only the regulated temperature but also the complete absence of dust, which at some seasons is more trying than the heat. Air conditioning, since it involves cleaning, remedies this.

Storage Air Conditioning for the Interurban Building in Dallas

By L. J. VAN SICKLE†

LATE in 1937, two prominent public utilities—Dallas Power & Light Company, and Dallas Railway & Terminal Company—announced plans for completely air conditioning their headquarters office buildings. The first of these already had in service partial air conditioning for sales room and customers' facilities on ground floor, and for part of second floor, but none of the office space in upper stories was equipped. In both instances, refrigeration storage was adopted for improving the characteristics and lowering the cost of electric power supply, by means of chilled water cooled at night and stored in insulated steel tanks until needed the following day. The systems in other respects represent the latest practice, including that for zone location of air-handling equipment and for zoning of distribution ducts throughout the building.

Located on opposite sides of Jackson Street, the two buildings represented complete contrast so far as physical details are concerned. The Dallas Power & Light building, 18 stories in height and of regular rectangular cross-section with setbacks at intervals, was occupied entirely by quarters for company staff and facilities for customers. Interurban Building, a U-shaped structure of 8 stories, contained a large waiting room for interurban trolley car and bus passengers, together with related drug store, cafe and barber shop on ground floor. The Railway Company occupied some office space on ground floor and second floor, but remainder of rentable space was leased to tenants, including Texas Power & Light Company, Employers Casualty Company and other well known concerns. Gross floor area of the 8 stories aggregated 117,000 sq. ft. and rentable area 88,700 sq. ft. Modernization of building in several respects was carried out simultaneously with installation of air conditioning. This article deals with arrangement of equipment and certain considerations governing the design, for Interurban Building; information on installation for Dallas Power & Light Company building, in which the author also participated, has already been covered in technical articles.

For the Interurban Building, a system was designed for summer air conditioning only to maintain a temperature differential of 20 degrees when the outdoor temperature was 100F, with an occupancy load of 1100 persons and electric lighting load of 275 kw. (about 2½ watts per sq. ft. of floor area). Windows were to be provided with venetian blinds and outdoor air introduced through the conditioners was to total not less than 30,000 c.f.m. The total air flow required was a minimum of 10 gross air changes per hour.

Loadings were stated in the job specifications, as were the design conditions. The actual details so far as refrigeration, air distribution, etc., were left to the various bidders, except for the refrigeration storage tank which was furnished under a separate contract.

In the design both horizontal and vertical zoning were utilized in the air distribution system. Ten conditioner locations were chosen. On the eighth floor an east zone conditioner served the east half of the seventh and eighth floors while the west zone conditioner served the west portion of the same floors. Similar conditioners were used on the sixth floor serving floors six and five, on the fourth floor serving floors four and three. Executive spaces occupied the location intended for the west zone conditioner on the second floor and only the east conditioner was installed on this floor to serve only the east zone of the second floor. On the first floor three conditioners were used, one to serve the east half of the first floor, another serving the west half of the first floor and a third serving the west half of the second floor.

All of these conditioners were made up of six row copper finned coils assembled in units of approximately 8 sq. ft. each, drain pans, two or more blowers and two-position motor-operated valves for control of the water flow through the coils. Motor valves were controlled by return duct thermostats. Our previous experience with modulating valves for varying the flow of cold water through conditioner coils has been unsatisfactory so far as the resulting relative humidity in the conditioned area was concerned.

Air velocities through the coils were in the neighborhood of 550 to 600 ft. per min. but due to the construction of the fins on the coils there was no carryover of entrained moisture. Variation of temperatures in the three horizontal zones which were served by each conditioner was held within close limits by means of modulating dampers governed by zone thermostats. There was no diversity between the loads on the two floors served by each conditioner, hence it was not necessary to use averaging control devices.

A problem arose in conjunction with the northwest, southwest and southeast corner rooms but this was solved by serving these corners from two different zones. Owing to the fact that the specified number of gross air changes was a minimum of ten and that the sensible load variation in a few of the corner rooms was on an average of 35 to 40% it was difficult to maintain a constant temperature in these rooms without at some time of the day going to an unusually high number of air changes.

Instead of resorting to some special means of control for these corner rooms special emphasis was given to the selection of outlets so that for even as high a variation of air changes as was required it was still possible to secure the desired temperatures without excessive noise or drafts.

†Air Conditioning Dept., The Murray Company, Dallas.

For the refrigeration storage, decided upon by building management as a means of improving the overall economies of the air conditioning system, a tank for storage of chilled water was installed by separate contractor, in basement space vacated by shifting dead storage of office records. Preliminary estimates covering refrigeration plants with varying amounts of storage and indicating seasonal costs for power and other items of operating expense, together with fixed charges on investment, were computed. It was found that a system using a tank capable of carrying 40% of the refrigerating load could be built at approximately the cost of a conventional system with no storage, and yearly fixed charges in both cases would be about the same. Saving in operating expense, as result of reduction in electrical demand charges, amounted to about $1000 per year.

Storage tank measured 24.5 ft. x 46 ft. x 14 ft. depth, giving 15,000 cu. ft. capacity at working water level 6 in. below top of tank. Construction was of welded steel plate, suitably stiffened and divided by six vertical transverse baffles, arranged for over-and-under flow from one end of tank toward the other. Bottom of tank rests directly on 6 in. concrete floor laid on thin layer of fill over solid rock substratum; one side and two ends were insulated with regranulated cork in 12-in. space between tank and adjacent masonry walls, while 3-in. cork board was applied on side exposed along passageway. Top was provided with removable 2-in. tongue-and-groove creosoted plank cover.

Based on 22F temperature difference of water, for 36F at shell-and-tube evaporator outlet and 58F return from air-conditioner coils, with 80% availability factor to allow for unavoidable mixing action due to effect of pocketing and of turbulence within the tank, computed storage capacity was 16.5 million B.t.u., equivalent to 152 tons for 10-hour working day at 90% daily load factor on peak-load day. No exact measurements of the actual capacity secured from tank were made during the first operating season.

The total calculated cooling load for the building was 340 tons of which 261 tons was sensible cooling and 79 tons was latent cooling, this load being divided into the following components:

Heat transmitted through structure, including sun effect	93 tons
Lighting	78 tons
Occupancy	48 tons
Ventilation air	100 tons
Power input to fans, chilled water pumps	21 tons
	340 tons

Of this quantity, the portion not available from the storage tank, 188 tons, must be furnished by daytime operation of the refrigerating plant.

For the refrigerating plant four General Electric re-

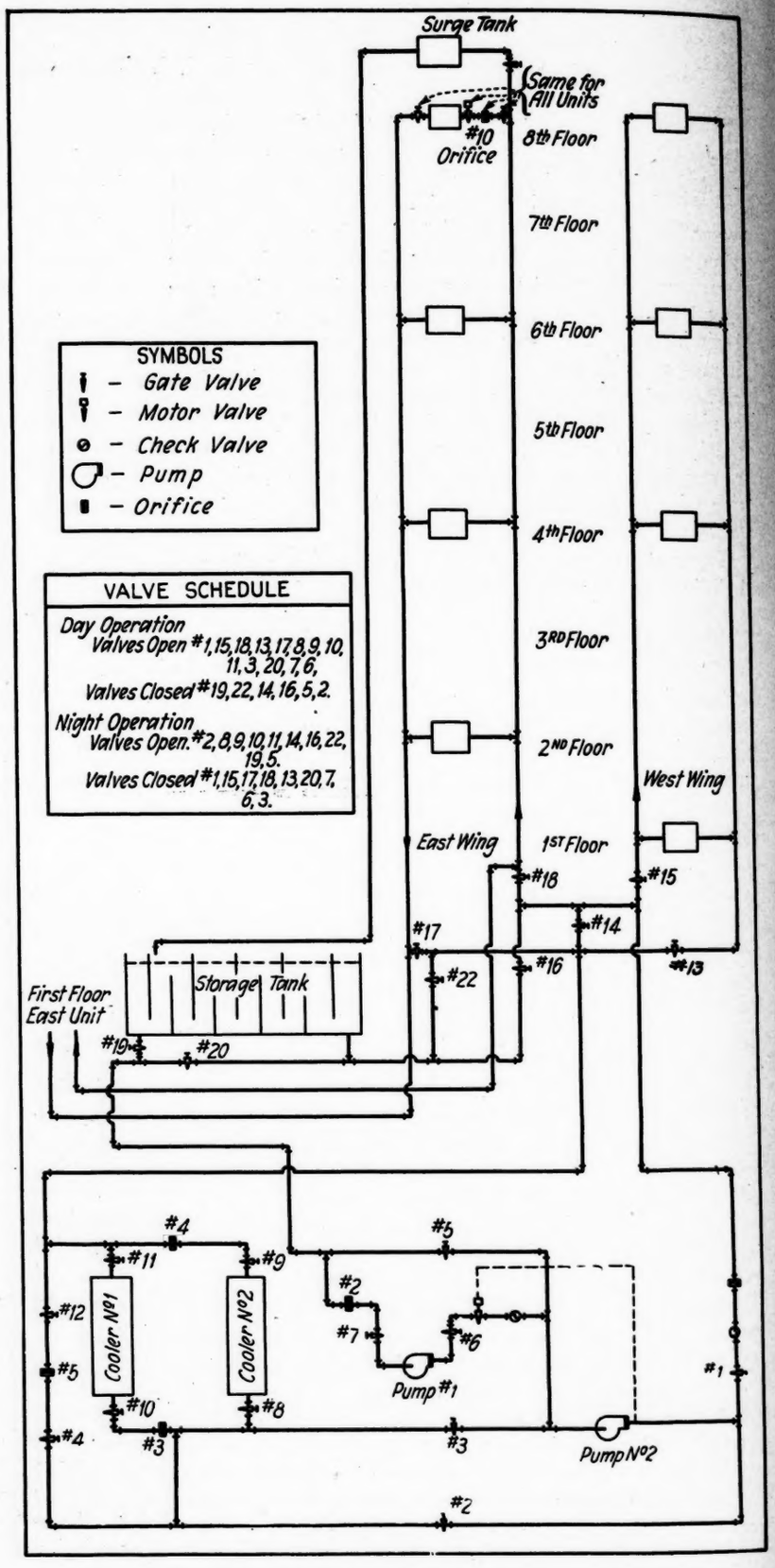


Fig. 1. Diagram showing piping arrangement and valve location and schedule for day operation and for night operation.

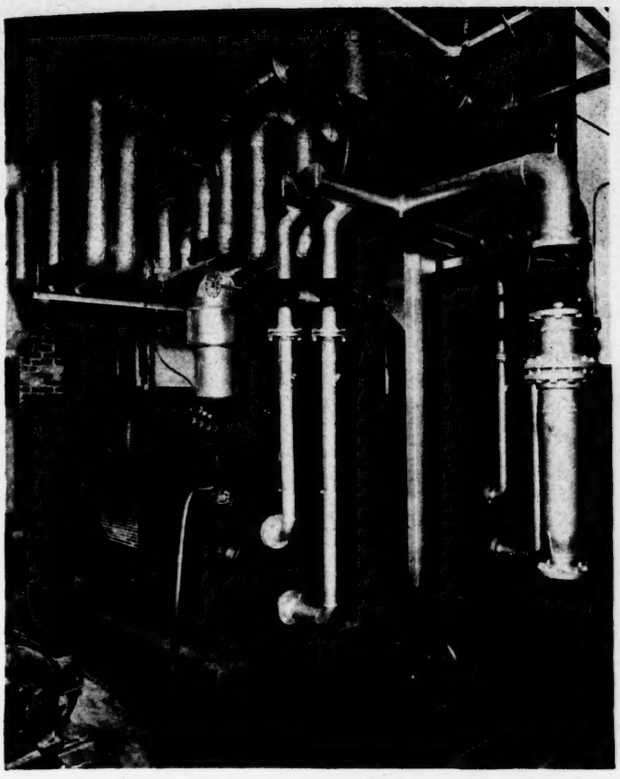


Fig. 2. Refrigerating plant showing two of the four hp. condensing units. Condenser water circulating pump in foreground.

ciprocating condensing units of V type were used, each powered with a 50-hp. motor, in conjunction with two two-circuit direct expansion shell and tube water coolers. Heat exchangers were designed and installed to prevent any possibility of any liquid refrigerant returning to the condensing units. In selecting the coolers the load was taken as the daytime operating load which consisted in cooling 825 gal. of water per min. from 58F to 53.2F. The balance of the cooling load was taken care of by supplying from the storage tank approximately 175 gal. per min. of 36-degree water. The water coolers were connected onto the intake side of the main circulating pump so that water was pulled through the coolers rather than pushed. This was done in order that the cold water from the storage tank might be introduced into the system after the return water from the cooling coils had passed through the water coolers resulting in an increased operating capacity for the compressors. The storage water pump operated against static head imposed by height of building, since for economy the storage tank in basement was of rectangular design with top open to atmosphere.

After selecting the coolers on the basis of daytime performance it was necessary to check them on the basis of their capacity during the night recharging cycle. To secure the optimum performance during the recharging cycle it was found better to circulate the water from the storage tanks through the coolers a number of times, each cycle resulting in a slight decrease in temperature, than to circulate the water from the tank through the coolers only once making the temperature reduction of 22 degrees in one step. The reduction was actually made in seven steps. With an initial temperature of 58F and a water flow of 1000 gal. per min. through the coolers, the first step reduction was 4.8 degrees. On the second trip through the coolers the water was cooled 4.6 degrees, the third 4.4 degrees and so on to the final passage through the coolers with a reduction of only 3.5 degrees.

Pipe connections were installed so that the change from the day operation to the night operation required a minimum of valving. To economize in piping cost, the pipes which were used in the daytime to convey water between pumps and conditioners were used at night to carry water from the pump to the storage tank. Only one additional pipe was required between the tank and the pump which was highly desirable since the tank was located some 220 ft. from the engine room of the building. Condenser water cooling is accomplished by a forced draft tower on the roof and a single condenser water pump is used to serve all four condensing units.

An immersion thermostat located in the discharge of the main circulation pump controls a modulating water valve which regulates the flow of cold water from the storage tank into the piping system. A second immersion thermostat located on the daytime discharge side of the coolers actuates a step controller which in turn controls the operation of the four condensing units, shutting off those not actually needed. (A set of double-pole double-throw switches may be used to reverse the sequence of the condensing units to prevent excess operation of any one unit.)

During the night operation on the charging cycle the water flow through the coolers is reversed. The day thermostat is disengaged from the control circuit and another immersion thermostat in the water line to the tank controls the condensing unit operation.

Fig. 3. East zone conditioner showing blower serving 6th floor.

The use of shell and tube water coolers of the dry expansion type with liquid refrigerant in the tubes reduces to a minimum the possibility of rupture of the tubes and consequent loss of the refrigerant due to freezing but as a safeguard both thermostats and pressurestats are inserted to halt the condensing units in case of excessive load, water temperatures, or high head pressures.

As originally scheduled the day operation cycle began at 7:30 A.M. and closed at 5:30 P.M. Allowing an hour to transfer the operation of the system from day to night operation, the charging cycle began at 3:30 P.M. and continued until 6:30 in the morning. In actual practice, however, it has been found that the storage tank could be operated between 35F and 55F and still afford ample cooling hence the night charging cycle could be shortened measurably.

It was at first intended to have a night watch engineer on duty during the charging cycle but by utilizing the services of a mechanic who has other duties in the building at night it was possible to operate the plant without another attendant.

To assure adherence to written operating instructions that have been compiled for guidance of attendants, a log for hourly entries is kept; these are regularly analyzed to determine overall performance and to detect promptly any derangement of controls or defect of equipment. Results obtained during latter part of 1938 season, following the trial runs and adjustment of system, have been uniformly satisfactory.

Acting as consultant in determination of general system design was W. F. Friend of Ebasco Services Incorporated; A. E. Vroome of Phoenix Engineering Corporation handled details of contract specification and supervision of installation work and trial operation. Most of the detailed design work was carried out by Hal Gibson of General Electric Company, and the writer. Contractor was The Murray Company of Dallas and Atlanta, whose superintendent in charge of erection was Joe Boyer.

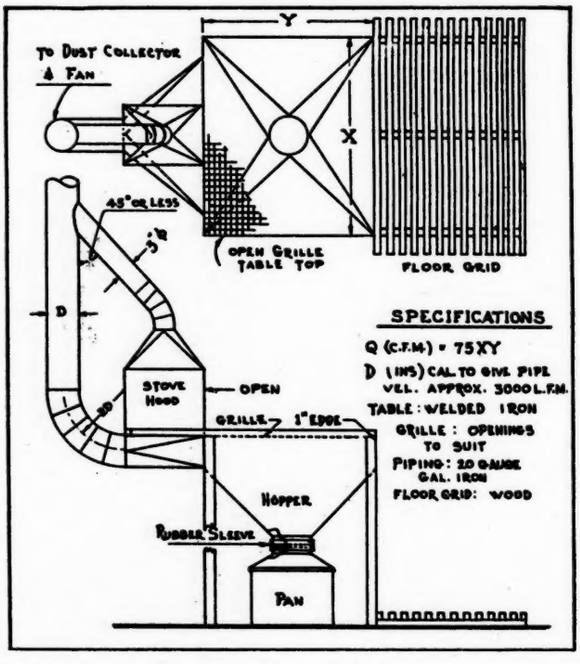
Ventilation of Soldering Benches to Overcome Lead Hazard†

By THEODORE HATCH‡

MISCELLANEOUS soldering operations on small tanks and the like frequently involve considerable filing, grinding and sanding of the soldered joints following the application of solder itself. There may be several men engaged full-time in this work and it may therefore constitute a definite health hazard unless properly protected. The hazard is two-fold:

1—Lead oxide fume is given off by the hot soldering iron.

2—Lead dust and cuttings are released by the filing, grinding and sanding.



Some of the dust released during cutting and filing is of an air-borne size and thus creates a direct exposure when thrown off. The bulk of the cuttings, however, are in the form of coarse particles which fall at once to the floor. But this material is soon ground to dust under the feet of workmen and disseminated again into the air unless the working area is cleaned at frequent intervals. Thus, in order properly to guard against the lead hazard two things must be done: Provide ventilation on the soldering iron stove and on the work table itself to remove the air-borne lead dust, and provide also for the confining of the lead cuttings and filings. The latter is best done by making use of an open grille on the work bench with a hopper below into which the cuttings fall. A work table of this sort is shown in the illustration. The rate of ventilation is calculated upon the basis of an average velocity of 75 l.f.m. through the table top. The manner of connecting the branch pipe is important since it is desirable to secure uniform ventilation over the entire area.

If the cuttings are not entirely confined to the table further protection may be had through the use of a raised floor grid which allows the cuttings to fall through and thus minimizes the grinding of the lead underfoot. The grid must be lifted at regular intervals, and the cuttings removed. Good housekeeping is an essential part of any program of control of lead.

This method of ventilation will not control lead dust given off by high-speed grinding wheels. For such work a semi-enclosing booth is required.

†Reprinted from the Industrial Bulletin of the New York State Dept. of Labor.

‡Associate Dust Control Engineer, Division of Industrial Hygiene, New York State Dept. of Labor.

Zoning, Orifices and Good Adjustments Reduce Steam Used in Boston Building

By CHARLES O. RADDEN†

ONE year ago the operators of a large office building confronted by rising steam bills and a lack of uniformity of heating conditions, agreed to a complete revision of their heating system. The building of about 2,280,000 cu. ft. was heated by a 2-pipe up-feed system with thermostatic traps on each radiator. More than 30,000 sq. ft. of radiator was supplied from one reducing valve.

The changes, finally decided on, were to include installation of radiator orifices, dividing the heating system into two zones, and the installation of automatic modulating pressure control valves for each zone.

A preliminary survey of basement piping was made to determine the possibility of zoning the building with separate systems for north and south exposures, and to determine allowable operating pressures on the systems. In order to zone as planned, it was necessary only to split the basement loop on the west end of the building and to connect one branch of the east end main into the north zone. (See Fig. 1.) We would then have the sunny side and the shaded side of the building supplied separately. Since all supply risers were installed with thermostatic traps, with the exception of one 10 ft. loop seal, it was apparent that the system could be operated at pressures up to 4 lb. If it was considered necessary to operate at higher pressures, a trap could be installed in this seal.

Our next step was to determine what would be the most desirable operating pressure.

For peak load conditions, it was calculated that radiator orifices sized for 1 lb. pressure drop would actually be operating with pressures before the orifices ranging from 1 lb. to 0.55 lb. This would mean that orifices as sized for 1 lb. pressure drop would be delivering simultaneously from 100% to 72% of their rating. To correct each orifice for the various initial pressures would be tedious work and the resultant accuracy would be questionable. Similar pressure drop calculations were made for 2 and 3 lb. orifice systems. Orifices sized for a 3 lb. pressure drop were found to be most satisfactory, for with an initial pressure of 3 lb. at peak load conditions, the maximum pressure drop in the supply piping was found to be 0.40 lb. In this case the variation in flow through the orifices would range from 100% to 92%. This would be the maximum condition, occurring only in zero weather. At lighter load, the pressure drop would vary with the square of the load and the same degree of accuracy would be maintained. This inaccuracy could be still further reduced by operating at higher pressures, but orifices would then begin to prove noisy and tolerances in drilling of orifices would be significant in affecting desired flow.

Having decided upon 3 lb. orifices, we made heat loss calculations, checking the size of installed radiation, and obtaining data on valve sizes. Most offices were found to be over-radiated, some greatly over-radiated. None being under-radiated, it was not necessary to relocate radiators; those that were too large being reduced in effectiveness by the orifices.

All indications were that this job would prove to be easy and inexpensive to orifice. Radiators were top connected and but few were concealed in enclosures so that radiator valve unions could be sprung apart easily. The only unusual item was the discovery that in one section of the building radiator valve unions had flat ground faces. For these radiators, flat brass discs, such as are kept in stock by hardware stores, were found to be ideally suited. Other orifices were standard union type.

Since it was decided that operation of the heating system was to be entirely automatic, we installed automatic modulating heating control valves, with heating up thermostats and a time switch to change from day to night and holiday settings.

The control valves would deliver four different pressures as determined by outdoor conditions of temperature and wind, and would shut off dead at between 60 and 65F outside temperature. With an outside tem-

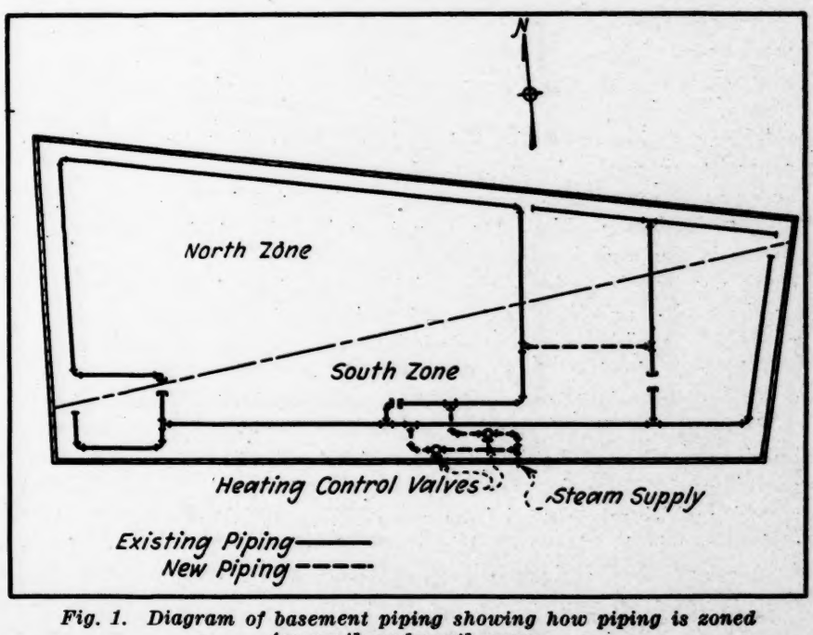


Fig. 1. Diagram of basement piping showing how piping is zoned for north and south zones.

†Boston Edison Company.

perature of 0F that is, full load, the control was sized and set to maintain 3 lb. on the heating system; at 18F outside, or ¾ load, the pressure would be 1 lb. 9 ounces; at 35F outside, or ½ load, the pressure would be 12 ounces and at 52F outside, the pressure would be 4 ounces for ¼ load. It will be seen that pressures on an orifice system do not vary directly with outside temperatures. Since the pressure on the low side of the orifice is above the critical pressure, the weight of steam passing through the opening is a square root function of the initial pressure and the ratio of the final and initial pressures.

Each zone valve is provided with a separate outside temperature box which completes one of four circuits as determined by outside temperature. The influence of wind is felt by a diaphragm, tending to increase the heating requirements. This box is connected to a separate pressure box feeling the pressure in the heating main of the zone. The outside temperature box closes one circuit passing through the pressure box sending current to a heat motor. When the pressure determined by the temperature is reached, the pressure box breaks the circuit shutting off current and permitting the valve to close. As long as one of the circuits is completed, current flows to a heat motor tending to hold open the control valve. (See Fig. 2.)

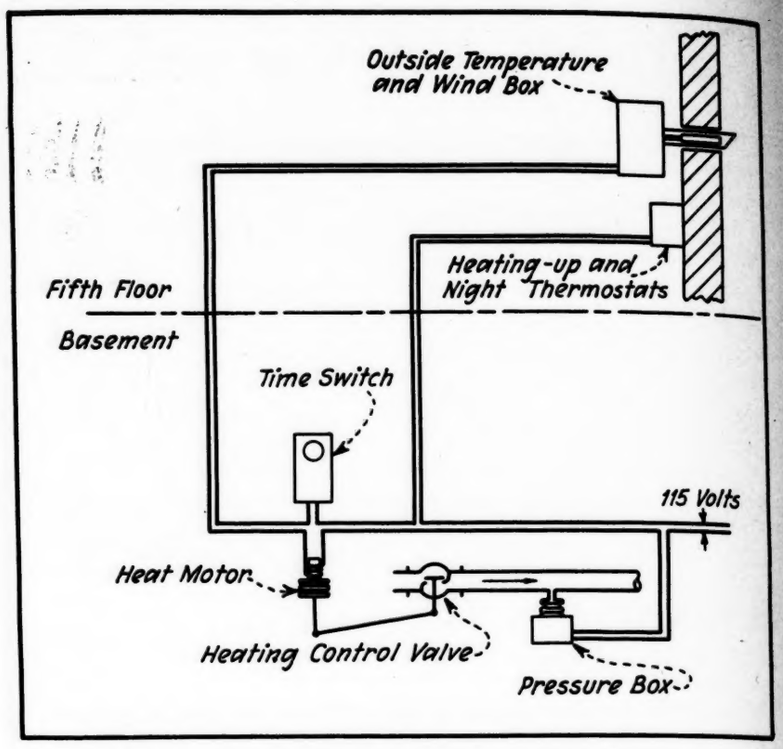


Fig. 2. Diagram showing principle of the automatic control method used.

Heating up thermostats were located centrally in each zone as were the temperature sensitive boxes, that is fifth floor offices of the 10-story building. These thermostats would bypass the outside controls and have the valves deliver 3 lb. until the zones were up to temperature. The outside boxes would then control the pressure delivered by the valves.

Night thermostats located with the heating up thermostats were set to maintain temperatures in the building above 60F because of cleaning women and others working at night. However, the building was well constructed and the windows were tight so that night turn-ons were rare.

Time switches were installed to change from the day control to the night thermostat. Hours were set to turn on so as to have the building up to 70F by 9:00 A.M., and to maintain this temperature until 6:00 P.M. Manual key switches were installed to bypass the clock so that, if desired, the building superintendent or the night superintendent could maintain day temperatures at night, Sundays, or holidays.

With the physical changes completed, our problem was to operate the system as economically as possible.

Temperature recorders were located throughout the building, each zone having one recorder in the room containing the heating up thermostat and another recorder which was moved from room to room as complaints occurred. Most complaints were found to come from rooms where the tenants were accustomed to turn the radiators on and off during the day. To these tenants we explained that we were attempting to operate so that it would be unnecessary for them to touch their valves. And only by this cooperation could we adjust controls or orifices to maintain desired temperatures. In addition, the cleaning women were instructed to check all radiator valves to see if they were open. In a few instances, tenants insisted on higher temperatures than we expected to maintain. In these rooms the orifices were enlarged to give satisfactory results.

It is easy to look back and say "controls were installed and adjusted to maintain satisfactory temperatures." Actually, equipment may be installed according to plans and specifications, steam turned on, only to find consumption running wild. Thermostats may be located in pockets or in rooms where conditions are scarcely typical of the rest of the building. Control settings may be such that on one pressure, room temperatures rise, while on another setting temperatures fall, and the heating up thermostat cuts in.

As stated above, the controls were set to maintain certain pressures for certain outdoor conditions. However, in warmer weather, we found temperatures building up 4 or 5 degrees due to lighting load and occupants. It was found necessary to have steam shut off dead at 60F outside and to have all settings, but the 3 lb. setting, cut in at lower temperatures.

Another change was necessary where we found a heating up thermostat being satisfied, while most of the zone remained cool. This thermostat had to be relocated toward the center of the room where it operated satisfactorily.

After a period of about two months for adjustment and changes, the heating systems were operating satisfactorily. Heating complaints no longer bother us and steam consumption is greatly reduced.

EDITORIALS

Prospects Continue Bright

Figures on sales, orders and shipments of equipment for the first half of 1939 are now available. They show a rather spotty situation but with virtually all items reporting an increase over the same period last year. Especially interesting is the 55% increase reported in the number of oil burners sold, the more than doubling of the amount of non-ferrous convector surface, and the substantial increase in the number of steel boilers. During the first five months refrigerating compressors (including receivers and condenser coils) reported orders booked totalling $1,780,000 of which those in sizes greater than 25 hp. accounted for more than $1,000,000, thus indicating to what an extent the large size compressor continues to dominate the picture. During this same period self-contained cooling units reported orders booked of over $1,630,000. In this group the unit having a cooling capacity of from one to five horsepower accounted for over half the total dollar volume. The relatively new self-contained units of more than five horsepower made a creditable showing with nearly $250,000 worth of orders reported. It is still too early to forecast accurately how the year's operations will shape up generally but it is apparent that the increase should easily meet the anticipated increase forecast in HEATING & VENTILATING early in the year.

Current reports covering activity in building construction also indicate that the anticipated increases are being well met. Especially in the small residence field the activity is the greatest in any recent year. Construction of new apartment houses and of new factory buildings is also reported in greater volume than for a long period. Without war upsets 1939 bids fair to show the best volumes of construction and replacement that we have experienced for some time.

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Low Cost Housing

Defeat of the housing bill with its proposed $800,000,000 appropriation was received generally with no great outcry but with rather mixed feelings. Those who have never been convinced of the wisdom of a publicly-financed venture into subsidized housing for the poor were naturally well satisfied as were those who feel that regardless of the merits of the case for such housing the time has come to call a halt to spending. Those who were directly affected through anticipated contracts naturally did not like the defeat. It remains to be learned how the intended beneficiaries of the housing may feel about it all.

The immediate effect of the defeat on the rate of activity of new building construction is not expected to be great. For one thing, a reduction of interest rates on new mortgage loans was announced at about the same time and this is expected to stimulate construction of small houses for the next few months at least. For another thing, the construction resulting from the proposed appropriation would not have got into contracts for several months anyway. What the long time effects are likely to be is still a question, and to a considerable extent a political question. Certainly the friends of housing for the poor will be active in the coming months. Certainly also the opponents will not be idle.

It is doubtful if the long time trend toward better living quarters for the poor is to be changed. What may quite easily be changed is the method of attack on the problem and the source of the funds with which to carry on. It is doubtful if, so far as this industry is concerned, the defeat of the recent appropriation is anything more than a postponement. Heating is too important to be neglected and no matter what means of financing or what form of construction may be adopted it is certain that heating will receive careful attention. Perhaps this feeling that only a postponement is involved had something to do with the rather indifferent way in which the action of Congress was received.

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A Commercial Standard for Oil Burners

A new commercial standard for mechanical oil burners is announced as effective on November first next. The announcement comes from the National Bureau of Standards which states that the new standard is to be called CS75-39.

Coming on the heels of the completion of the safety standards for mechanical refrigeration the appearance of this is another example of how industry groups can get together to draw up workable standards when the incentive is strong enough. In the case of the oil burner group the procedure of a government organization was followed instead of that of a privately sponsored one. The point is that there are several methods of procedure available to all who want to use them. Failure to clarify some of the bad situations in the industry can not be laid to any lack of existing machinery for the purpose but rather to a lack of incentive in some instances and to plain failure to agree on the details in others.

The record of the results accomplished by codes or standards is not always impressive but in the case of the oil burner standards there is every reason to believe that at least some of the worst features of a situation which plagued the whole group may be improved noticeably by the mere existence of a definite set of rules covering such points as laboratory test procedure and installation and performance tests. Provision of a certificate to accompany each burner and thus to offer the ultimate purchaser some measure of protection is also a feature which without doubt might operate to the very great benefit of the whole group. Whether it will live up to the possibilities or not is something which only time will tell. The chances are good however for there is now a means at hand whereby pressure can be put on individuals or firms who take part in slipshod installations.

ABSTRACTS of Current Papers, Books and Pamphlets

Heating and Air Conditioning

In this, the fifth edition of this well known textbook, the more important changes have been made in the section dealing with air conditioning. These changes have been necessitated by the rapid progress in the field of air conditioning during the four years since the last edition was written.

In the air conditioning section material has been added on such subjects as controls, air distribution, cooling coil performance and cooling load calculations. An important new feature in this section is a chapter devoted to a complete step-by-step calculation and design of an air conditioning problem.

The most noteworthy change in the chapters dealing with heating has been the division of the chapter on warm air furnace heating into two chapters, one dealing with gravity furnaces and the other with mechanical furnaces.

For those unfamiliar with previous editions of this book it may be said that its purpose is to serve as a textbook for use both in engineering schools and by the individual student attacking the subject by himself. In accordance with this purpose problems are given at the end of most chapters and bibliographies of suggested readings are also included. Numerous illustrations, both sketches and photographs, are used to illustrate typical equipment.

A list of subjects covered by the book follows: Heat and the Properties of Steam and Air; Heat Losses from Buildings; Methods of Heating; Gravity Warm Air Furnace Heating; Radiators, Convectors and Unit Heaters; Fuels and Boilers; Steam Heating Systems; Pipe, Fittings, Valves, and Accessories; Steam Piping; Hot-Water Heating Systems; Automatic Control; Central and District Heating—Electric Heating; Air and Its Properties; Principles of Air Conditioning; Ventilating and Air Conditioning Systems; Fans, Filters, Washers and Coils; The Transmission and Distribution of Air; Cooling and Dehumidifying Apparatus; The Cooling and Dehumidifying Load; The Design of an Air Conditioning System; Residence Air Conditioning; Unit Air Conditioners; Industrial Air Conditioning.

[*"Heating and Air Conditioning," by John R. Allen and James Herbert Walker. 5th edition. Published by McGraw-Hill Book Company, Inc., 330 West 42nd St., New York, N. Y. Cloth cover; 6 x 9 in.; 593 pages; price, $4.50.*]

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Significance of Dust Counts

Much of the confusion arising from the interpretation of dust counts may be traced to the lack of appreciation regarding their actual significance. Many investigators have neglected the limitations of the technique used and this failure has caused much serious criticism as to the value of counts in evaluating a dusty environment. This has been especially true when attempts were made to comprehend the meaning of wide variations in results so often obtained. One is led to inquire, therefore, what the criteria are which make dust counting definitely valuable.

Dust counts have a threefold application: (1) they are an index of the cleanliness of a plant; (2), they help to determine the effectiveness of dust-removal equipment; and (3) they can be used in conjunction with medical data to determine the threshold or safe limit of exposure to a specific dust. In practice, the first and second applications are more often used than the third. It is of importance to check upon the performance of control measures in order to protect workers from excessive dust exposures. Dust counts are a quantitative measure of environment, which, coupled with a knowledge of the safe or threshold limit, tell whether the conditions found are inimical to the health of workers. The third application of dust counts, namely, their use in establishing threshold limits, is a research function.

In order to understand the causes of the difficulties encountered by so many investigators in making dust counts, there is discussed in this paper the characteristics of instruments and techniques generally used for dust sampling, the environmental conditions affecting the sample, and the methods of averaging and weighting of counts in order to arrive at an index of dustiness which accurately defines the environment of the worker. These factors have a direct bearing on the applications of dust counts mentioned above.

[*"The Significance of Dust Counts," by J. M. Dalla-Va'le. Published in the Public Health Reports, June 23, 1939, pages 1095-1104. Copies available from Superintendent of Documents, Washington, D. C. Price, 5c.*]

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Handbook of Chemistry and Physics

Practically everyone who practices one or another form of engineering has the need for a source book which will give him information on basic sciences such as mathematics, physics and chemistry. One of the best known books of this type is the "Handbook of Chemistry and Physics"—now in its 23rd edition.

The book is divided into five main sections entitled as follows: Mathematical Tables; Properties and Physical Constants; General Chemical Tables and Specific Gravity and Properties of Matter; Heat; Hygrometric and Barometric Tables; Sound; Electricity and Magnetism; Light; Quantities and Units; Conversion Tables and Miscellaneous Tables.

While heating and air conditioning engineers will find something of interest in all the sections probably the one of most interest is entitled Heat and Hygrometry. Included in this section are tables on specific heats, vapor pressures, thermal conductivities, steam properties, and hygrometric data.

[*"Handbook of Chemistry and Physics," 23rd edition. Published by the Chemical Rubber Publishing Co., 1900 West 112th St., Cleveland, Ohio. Available in either fabricoid or de luxe binding. 7½ x 5 in.; prices, fabricoid, $3.50; de luxe binding, $6.00.*]

Domestic Hot Water Manual

It is the purpose of this manual to give complete and reliable information on selection, use and installation of gas water heaters for domestic hot water supply in buildings of all types.

The book is divided into four sections, the first dealing with the advantages of gas for water heating while the second takes up three steps in selecting the water heater and type of system. The data given in this section applies directly to domestic hot water supply problems that are normal. More data and information on complex problems are given on succeeding pages.

In the third section is to be found information on types of gas water heaters, what they are, the type of service they give, the type of building for which they are most suitable, and how to select them. This part is further clarified by definite figures and tables.

The last section of the manual deals with designing domestic hot water systems and it presents basic data and designs for hot water systems for small homes and for large installations. The manual concludes with information on such details as heater flues and chimneys; leaking faucets, fittings and attachments. There is also a section on specifications for the hot water supply system covering requirements of the average domestic hot water system.

[*"Domestic Hot Water Systems," by T. S. Rogers. Available from the Association of Gas Appliance and Equipment Manufacturers, 60 E. 42nd St., New York or the American Gas Association, 420 Lexington Ave., New York City. Heavy paper cover; 8½ x 11 in.; 24 pages. Price, 50 cents.*]

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BRIEF REVIEWS

HUMIDITY. A discussion of effect of humidity on paper and printing including causes of misregister in printing, curl, wavy edges, wrinkling, static electricity, web breaks, cracking of coated paper, conditioning paper, effect of relative humidity on physical tests, effect of atmospheric moisture conditions on ink, make ready difficulties and half tone printing. Bibliography. [*"Effect of Atmospheric Humidity on Paper and Printing," by W. C. Dahl. Paper Trade Journal, June 29, 1939, page 25-28. Published by Lockwood Trade Journal Company, Inc., 15 W. 47th St., New York, N. Y. Single copies, 10 cents.*]

DUST COUNTING. A brief discussion of the shattering of dust particles in impinger dust counting equipment. [*"A Note on the Shattering of Dust Particles in the Impinger," by H. H. Watson. Published in the Journal of Industrial Hygiene and Toxicology, Vol. 21, No. 4, April, 1939, pages 121 to 123. Copies available from the Williams & Wilkins Co., Mount Royal and Guilford Aves., Baltimore, Md. Price, 75 cents.*]

AIR CONDITIONING SAFETY CODE. A handbook listing the safety regulations of the Board of Fire Underwriters for the installation of air conditioning, warm air heating, air cooling and ventilation systems. See page 36 for a complete review. [*"Regulations of the National Board of Fire Underwriters for the Installation of Air Conditioning, Warm Air Heating, Air Cooling and Ventilating Systems." NBFU pamphlet No. 90. Published by the National Board of Fire Underwriters, 85 John St., New York, N. Y. Paper cover; 4 x 6¼; 27 pages; available on request.*]

POWER CONFERENCE. Reprint of the proceedings of the 1939 Midwest Power Conference which was held by the Armour Institute of Technology at the Palmer House, April 5-7, 1939. Contains a registration list and reprints of all papers. Among the papers of interest to heating and ventilating engineers are the following: Reducing Pollution of Air by Power Plants; Control of Pollution in Chicago's Air; and Problems of the Small Industrial Power Plant. [*"The Proceedings of the 1939 Midwest Power Conference." Published by the Armour Institute of Technology, Chicago, Ill. Heavy paper cover; 6 x 9 in.; 155 pages; price, $2*]

ARC WELDING. A book made up of the 109 papers which were awarded prizes in the recent $200,000 award program of the James F. Lincoln Arc Welding Foundation. The first section of the book gives information regarding the Foundation and the award program as well as an alphabetical list of authors. The remainder of the book is divided into ten sections entitled as follows: Automotive; Aircraft; Railroad; Watercraft; Structural; Furniture and Fixtures; Commercial Welding, Automotive Repair, Welderies; Containers; Machinery; and Jigs and Fixtures. [*"Arc Welding in Design, Manufacture and Construction." Published by the James F. Lincoln Arc Welding Foundation, P. O. Box 5728, Cleveland, Ohio. Simulated leather cover; 6 x 9 in.; 1408 pages; price, $1.50 postpaid in the United States, $2 elsewhere.*]

ESTIMATION OF MERCURY IN AIR. A brief discussion of the properties of mercury, the methods by which it may be introduced into air in industrial plants, and the methods of estimating the quantity of mercury vapor in the air. [*"Estimation of Mercury in Air," by W. J. Burke, S. Moskowitz, and B. H. Dolin. Published in The Industrial Bulletin, May, 1939, pages 235-6. Bulletin published by The Industrial Commissioner of New York State, Albany, N. Y. Price, single copies, 10c.*]

RESIDENTIAL BUILDING. A technical monograph on one phase of housing. Deals with some of the broader background factors which influence the demand for housing and the method of supplying the demand. [*"Housing Monograph Series No. 1, Residential Building," by L. J. Chawner. Published by the National Resources Committee. Paper cover; 9 x 11½ in.; 19 pages; price, 10 cents. For sale by the Superintendent of Documents, Washington, D. C.*]

STANDARDS. Annual list of standards and safety codes including some 400 nationally approved standards, safety codes and specifications. Codes are indexed alphabetically and also industrially according to subject. [*"Indexed List of American Standards." Published by the American Standards Association, 29 W. 39th St., New York. Paper cover; 8½ x 11 in.; 12 pages; free.*]

AIR CONDITIONING. A reprint of the papers presented at the 2nd conference on air conditioning held at the University of Illinois, March 8 and 9, 1939. Subjects covered include, Equipment for All-Year Air Conditioning; Characteristics of Duct Systems and Fans; Introduction and Diffusion of Conditioned Air in Rooms; Regulation of Air Temperature and Humidity; Refrigerating Problems in Comfort Air Conditioning; Building Insulation: Types and Applications; Condensation Problems in Modern Buildings; Air-Conditioning Water Supply and Disposal; Conservation of Water by Using Cooling Towers and Evaporative Condensers; Thermal Interchanges Between the Body and Its Atmospheric Environment. [*"Papers presented at the Second Conference on Air Conditioning," Circular 37, published by University of Illinois Engineering Experiment Station, Urbana, Ill. Paper covered, 6 x 9 in.; 151 pages. Price, 50 cents. A supply of free copies is available for a limited time.*]

BUILDING BOARDS. One of the series of studies of the National Bureau of Standards on building materials, and covering the study of fiber building boards. The study deals primarily with the accelerated aging of these materials to determine how they may be expected to retain their properties under actual use conditions. [*"Building Materials and Structures Report BMS13, Properties of Some Fiber Building Boards of Current Manufacture," by Charles G. Weber and Samuel G. Weissberg. Published by the U.S. Department of Commerce, National Bureau of Standards. For sale by the Superintendent of Documents, Washington, D. C. Size 8 x 10½ in.; 5 pages; price, 10 cents.*]

REFRIGERATION STANDARDS. First revised edition of the American Standard Safety Code for Mechanical Refrigeration. For a complete review of this Code see page 39 August 1939 issue. [*"American Standard Safety Code for Mechanical Refrigeration" A.S.A.-B9-1939. Published by The American Society of Refrigerating Engineers, 37 West 39th St., New York. Paper cover, 8½ x 11 in.; 14 pages. Price, 20 cents.*]

WELDING. A discussion of the oxy-acetylene welding of sheet metal, including advantages, factors affecting design, control of expansion and contraction, welding techniques, holding devices, principles of jig design, cleaning and welding procedure. [*"Fundamentals of Sheet Metal Welding," published in the April, 1939, edition of Oxy-acetylene Tips, 30 East 42nd Street, New York, pages 73 to 79. Available on request.*]

SALT IN AIR. A description of an apparatus for determining the salt content of air. [*"Apparatus for Determining the Salt Content of Air," by Woodrow C. Jacobs, published in the February, 1939 issue of the Bulletin of the American Meteorological Society. Blue Hill Observatory, Harvard University, Milton, Mass. Single copies 35 cents.*]

ATTIC VENTILATION. A sales promotional booklet for acquainting home owners with the advantages of attic ventilation and intended as a guide to architects and contractors. [*"Installation Recommendations and Data on Attic Ventilation." Standard size, 12 pages, with numerous illustrations. Published by the General Sales Department, New Orleans Public Service Inc., New Orleans, La.*]

HEAT TRANSFER. Based on a theoretical concept of the process of evaporation and on experiments carried out with water and with carbon tetrachloride boiling at atmospheric pressure, a formula for heat transfer in violent evaporation has been derived. The purpose of this paper is to demonstrate how this formula can be interpreted and modified in order to be applied also to much lower and higher pressures. [*"The Influence of Pressure on Heat Transfer in Evaporation" by Max Jakob. Technical Bulletin, Vol. 2, No. 1, July, 1939. Armour Institute of Technology, 3300 Federal St., Chicago, Ill. Paper cover; 6 x 9 in.; 4 pages. Available on request.*]

DUST CONTROL. A mimeographed publication of the Pennsylvania Department of Labor dealing with the control of dust in connection with the manufacture of abrasive wheels. [*"Abrasive Wheel Manufacture, Technical Control of Dusts" by Fred. F. Kravath, assistant plant engineer of the Abrasive Company, Division of Simonds Saw and Steel Co. Safe Practice Bulletin No. 13 published by Department of Labor and Industry, Commonwealth of Pennsylvania, Harrisburg, Pa. Mimeographed, standard size, 9 pages plus 4 pages of plates. Obtainable without charge.*]

MECHANICAL ENGINEERING. A discussion of mechanical engineering as a career giving information on the fields of mechanical engineering; types of positions; working conditions; education required; opportunities and income. [*"Mechanical Engineering as a Career." Published by The Institute for Research, 537 South Dearborn St., Chicago, Ill. Heavy paper cover; 8½ x 11 in.; 20 pages. Price, $1.00.*]

STANDARDS. Standards covering the following types of fans: desk and bracket, ceiling, ventilating and air circulator types. Standards give information on ratings, performance requirements, general guarantees and manufacturing practice. [*"NEMA Fan Standards." Publication 39-56. Published by the National Electrical Manufacturers Association, 155 E. 44th St., New York. Paper cover; 8 pages; price, 10 cents.*]

DUST RECOVERY. A description of a practical method of recovering siliceous material in the roofing coating industry. Material recovered is chiefly crushed slate, pulverized mica and finely ground soapstone. Includes a diagram of actual equipment and data on air velocities in various pipes and hoods. [*"Collecting and Reclaiming Siliceous Dusts in Roofing—Coating Industry." Safe Practice Bulletin No. 3. Published by the Department of Labor and Industry, Commonwealth of Pennsylvania, Harrisburg, Pa. Paper cover; 8½ x 11; 7 pages. Available on request.*]

GLASS INSULATION. A discussion of the use of glass wool insulation in modern streamline trains and of the methods of avoiding potential hazards in the handling of glass fibers. [*"Insulation in Stream-Lined Trains." Safe Practice Bulletin No. 2. Published by the Department of Labor, Commonwealth of Pennsylvania, Harrisburg, Pa. Paper cover; 8½ x 11; approximately 10 pages. Available on request.*]

NEWS OF THE MONTH

Texas A & M College Holds First Annual A. C. Short Course; Speakers Include Giesecke, Howatt, Shugars and Kunen

COLLEGE STATION, TEXAS—The First Annual Air Conditioning Short Course of the Texas Agricultural and Mechanical College was held here Aug. 17-19 and was attended by 95. The course was sponsored by the School of Engineering.

The address of welcome was given by Gibb Gilchrist, Dean of Engineering, who expressed his pleasure at the large attendance and told the group that the two important features of engineering education at the present time are air conditioning and aeronautics, and that Texas A. & M. will use its facilities in research, education, and extension to assist in the development of these important phases of engineering.

The address of welcome was followed by a paper on "Air Conditioning for Human Comfort," by Professor H. E. Degler of the University of Texas, who discussed recent studies in determining the conditions required for human comfort and the importance of the use of effective temperature as a measure of comfort conditions, and stressed the use of attic ventilation and the importance of building construction as an adjunct to air conditioning. In addition to attic ventilating, he called attention to the importance of evaporative cooling, use of ice in cooling, and cold accumulators.

Dr. F. E. Giesecke, Director of the Texas Engineering Experiment Station of the Agricultural and Mechanical College, presented a paper on "Research as Related to Air Conditioning," in which he reviewed briefly the various cooperative research projects which the ASHVE is conducting in cooperation with universities, colleges, and other institutions.

J. D. Poythress, Minneapolis-Honeywell Regulator Company, gave an informal discussion on pneumatic controls as applied to air conditioning installations and expained the difference between the bleeder type and the non-bleeder type of control.

Hal Gibson, General Electric Company, presented a paper on "Air Conditioning Equipment; Its Functions and Some Factors Influencing Its Selection." He discussed the many different types of air conditioning installations and fully described the construction and functions of each particular piece used in air conditioning installations.

A paper entitled "Air Flow and Distribution," by Herbert Kunen, Anemostat Corporation, described in detail the construction and operation of his company's rosette type grille, and also brought out the importance of correct duct design for securing proper air distribution through the different branches. This paper was illustrated by means of models and induced considerable discussion, led by H. E. Shugars, Barber-Colman Company.

A paper on "Air Conditioning Controls," by Mr. Shugars, discussed the common control systems now in use in air conditioning installations for both heating and cooling systems. He emphasized the fact that the control system must be flexible in order to insure proper operation of the equipment under continually varying loads caused by changing weather and internal load fluctuations in the building.

A paper entitled "Side Wall Distribution of Air" by Mr. Shugars, explained in considerable detail by slides the application of grilles in side wall air distribution. He stressed the location of the return air grille as having a major bearing on the successful operation of an air conditioned space, and showed by photographs of smoke tests the actual flow of air through the conditioned space.

Other speakers included A. M. Chase, York Ice Machinery Corp.; J. W. Miller, Texas Electric Service, Wichita Falls; John Howatt, Chief Engineer, Chicago Board of Education; A. J. Rummel, San Antonio Public Service Co., and W. E. Stark, Bryant Heater Co.

Sun Heat for Housing Project

PITTSBURGH—The sun may give low-cost hot water to people living in McKees Rocks' projected low-cost housing development.

According to the Allegheny County Housing Authority, water warmed by the solar system will be furnished free to tenants in 310 home units planned for the borough.

As described by the authority, shallow, glass-covered boxes would be installed on roofs of the units to concentrate sun rays against copper water pipes running to insulated storage tanks.

Within in a few hours—in cold weather as well as hot—the water will be heated to 180F.

First experimental installations of the solar heaters have been ordered by the Miami Housing Authority for low-cost housing there.

Theater Chain to A.C. Four Houses

BUFFALO—Because of the increased business in the Senate Theater due to the recent installation of an air conditioning system, each of the four remaining Buffalo movie houses of the Konczakowski chain are in line for similar improvements.

Since re-opening of the renovated theater Aug. 11, the movie house has daily played to capacity audiences, according to Matthew M. Konczakowski, Sr., president of the chain, mainly because of extensive advertising of the air conditioning system.

The system was installed by the Cooney Refrigeration Co., Inc.

N. Y. Industrial Building Increases

ALBANY, N. Y.—One-hundred-twenty-three plans for construction work on industrial plants in New York State outside of Greater New York City were submitted during July for the approval of the State Department of Labor. This number is the second largest submitted during July in the 16 years that such plans have been subject to Department approval.

Registrants and speakers at the first annual air conditioning short course of Texas Agricultural and Mechanical College.

Workers' Time Lost by Illness Cut 28% by Air Conditioning, According to Records of Several Installations

WASHINGTON—Air conditioning accomplishes a 28% reduction in those illnesses which cause an office employee to stay home from work, according to an analysis of results of a survey of several installations. The survey was made by W. B. Henderson, executive vice president of the Air Conditioning Manufacturers' Association.

In Cincinnati, the Proctor and Gamble Company, which occupies five floors of an air conditioned building, reports that the loss of employees' services from colds and other respiratory ailments was cut from an average of 2.2 to 1.6 days per worker per year during the first 12 months of air conditioning, a decrease of 27%.

In San Antonio, Texas, the United Services Automobile Association disclosed that absences due to illnesses were reduced from 7.5 to 5.5 days per worker per year with the installation of air conditioning, a decrease of 27%.

In Philadelphia, the Philadelphia Electric Company has been keeping accurate absentee records for the past seven years, in order to compare the health level of employees in district offices equipped with air conditioning against those in offices without it. The number of days lost per 100 employees has been less in the air conditioned offices by the following percentages for each fiscal year:

1932-1933	38%
1933-1934	30%
1934-1935	21%
1935-1936	35%
1936-1937	7%
1937-1938	43%
Six-Year Average	29%

In the Tribune Tower in Chicago, which was completely air conditioned five years ago, monthly records have been kept of the number of employes who were sick enough to stay home from work, and their total lost days. The improvement in health of Tribune employees is shown by the following reductions in total lost days per year from the average for the year before air conditioning was installed:

1934	25%
1935	46%
1936	2%
1937	25%
1938	53%
Five-Year Average	30%

The epidemic of influenza which gripped the Middle West in the winter of 1936 is readily apparent in the Tribune's low figure of 2% for that year. In commenting on this figure, however, J. P. Kreutzer, manager of the Tribune Employees' Benefit Plan Department, said the Tribune staff suffered far less from the epidemic than Chicago firms which did not have air conditioning.

Mr. Henderson estimates that the extension of air conditioning to all workers throughout the country would effect a savings of $600,000,000 per year in the present economic loss to industry due to employee illnesses.

Buffalo Groups Unite in Program

BUFFALO — The Air Conditioning Council of Western New York, the Buffalo Stokers' Association and the Buffalo Oil Burner Association will join forces this Fall to present a better program for members of the three associations, according to Walter P. Davis, executive secretary of the Air Conditioning Council, who said the program for the new season will be designed for sales and promotional education rather than technical discussion.

"Because the same general sales ideas prevail in these three organizations and because they apply the same sales psychology, members have agreed it would be for the best interests of all to unite program activities this year," Mr. Davis said.

"Under this arrangement, we can have an audience of at least 200 to hear every speaker and thus will be in a position to obtain some of the best authorities in the country." The first meeting will be held around the middle of October with the speaker being announced in the near future.

Mr. Davis said the Air Conditioning Council looks for a very active season with a good exchange of ideas. This is the third year of the Council's existence and it now has 57 members. The Buffalo Stokers' Association and the Buffalo Oil Burner Association have about 30 members each.

Evans Heads Toronto A.C. Group

TORONTO—The Air-Conditioning Industries branch of the Board of Trade of the City of Toronto recently completed its first year. The election of officers at the annual meeting resulted in W. H. Evans, Minneapolis-Honeywell Regulator Co., Ltd., being named chairman, and W. G. Mason, General Steel Wares, Ltd., as vice-chairman.

During the year the branch accomplished much headway in influencing the formulation of codes and by-laws to protect the public and assist the industry. The matter of air-conditioning correspondence schools was also discussed, as well as the abuse of the term air-conditioning by certain firms or individuals.

Anthracite Stoker Sales Increase, Dept. of Commerce Study Shows

WASHINGTON—The Department of Commerce has studied the reports of sales of 13 makers of anthracite stokers using less than sixty-one pounds of coal per hour.

The statistics obtained include practically data on all of the representative producers in the anthracite stoker group. The Bureau found that while the total of 9,074 sales of Class 1 anthracite stokers for 1937 included sales by twenty-one manufacturers, and the total of 12,651 sales in 1938 included reports of twenty-seven manufacturers, some of these establishments have now discontinued the production of anthracite machines and several others were unable to furnish back data, which accounts for the difference shown in the figures in the following tabulation and the figures released monthly by the Bureau of the Census:

Sales of Class 1 Anthracite Stokers (capacity under 61 pounds of coal per hour) by 13 manufacturers 1/: 1930 to 1938

YEAR	No.
1930	4391
1931	3623
1932	2787
1933	2427
1934	3613
1935	4787
1936	6029
1937	7706
1938	10,437
TOTAL	45,700

1/ Of these 13 manufacturers, 5 began the production of Class 1 Anthracite Stokers prior to 1930 or in that year; 1 began in 1931; 1 in 1933; 1 in 1934; 2 in 1935; 2 in 1936; and 1 in 1937.

401 Customers for Boston Steam

BOSTON — The 401st steam customer was connected to the Boston Edison Company's steam mains recently, when the Boston Public Library began using both Edison steam and electric service. Engines and generators used in the library for nearly a half century, were removed, some of them to Henry Ford's museum, and the boiler room was turned over to regular library uses.

ASHVE Plans Fall Meet in Atlanta

ATLANTA — Announcement has just been made of the inaugural fall meeting of the ASHVE to be held here October 30-31 with the Atlanta chapter of the society as hosts. It is planned to have three technical sessions, a get-together luncheon, a banquet and dance, and a program of special entertainment for ladies.

The council will meet at the Atlanta Biltmore Hotel on October 29 preceding the general society meeting.

Seattle, with Low Electric Rates, Develops Its Own Heat Pump; 2 Mill Equivalent Rate Claimed for this Method

SEATTLE—Despite the loss of its leader, J. D. Ross, head of City Light of Seattle, recently deceased, who took a leading part in development of electric heating. City Light engineers are striving to carry forward development of a heat pump which Mr. Ross was working on.

In the recent annual report of City Light, lately released, it is shown that a quarter-century of electric heating experience and hundreds of practical tests in Puget Sound climate indicate that electric home heating by resistance type heater, either direct or through hot water storage, cannot compete economically with either coal or oil.

However, since the report, the utility announced, effective in September, sizable electric rate cuts.

Stressing the heat pump, well on the way in Seattle, the annual report of the municipal electric power department premises: "In the mild climate of Puget Sound region the cyclic system of heating, whereby heat is taken from the outside air and liberated inside through the agency of a refrigerant and a motor-driven compressor, is an ideal system of heating. The efficiency of such a cycle as a heat pump rises rapidly with the temperature of the outside air, and little advantage can be gained by its use in freezing climates. For that reason the market for a machine operating by 'reversed refrigeration' as the principle is called, is naturally limited to mild climates where there are no severe winters.

"The department is working out in its own shops a heating machine of this sort, and is getting results that warrant the perfecting of the system. Tests indicate a probable heating ration in this climate varying from 4:1 to 2:1 depending upon outside conditions. That is, for the most favorable weather conditions, three times as much heat energy is transferred from outside into the room as is consumed by the motor. Since the motor energy is also released as heat in the system, we actually get four times as much heat in the room as we would get by using the same amount of electric energy in an electric heater. This means, under these conditions, that a 5-kilowatt compressor would equal 20 kilowatts of resistance heaters, which would be ample for the 5-room house. It also means that the present low block of the residence rate, ¾c. per kilowatt-hour, would be equivalent to a rate of less than two mills per kilowatt-hour for heating. From these facts it is evident that such a heating system would bring a heavy demand for current, probably enough to double the entire present demand on City Light. The problem of commercial manufacture of the apparatus at a price that will permit its widespread use, is a considerable one. The compressor must be dependable, noiseless and inexpensive, and radiators and cooling coil must exchange heat rapidly with very low temperature gradients. Complete air conditioning equipment to supply clean air of just the right humidity may easily be added. Because of its large potential use for electric energy and great value in comfort and convenience in the home, the Department is carrying on the development of the apparatus for this system of heating in the hope that it may be placed within the reach of the average home owner."

Phila. ASRE Plans 1939-40 Program

PHILADELPHIA — The Philadelphia section of the American Society of Refrigerating Engineers has completed a tentative program for the coming winter and spring. Following the practice started last year, meetings will be held alternately in Philadelphia and out of town. The outside cities in which meetings will be held this year are York, Wilmington, and Reading. Last year meetings were held in Baltimore, but the Society has now established a section in that city.

The contemplated program calls for one main speaker at each meeting, who will read a prepared paper, and two supporting speakers. The first meeting will be held on October 6th, at the Architects Building, Philadelphia. Persons interested in these meetings can have their names placed on the mailing list to receive notices of the meetings and programs by writing the secretary of the section, R. B. Davis, care of Melchior, Armstrong, Dessau Company, 1516 Callowhill St., Philadelphia.

A.C. Bureau to Hold 6th Outing

BOSTON—Plans have been made for the sixth annual outing of the Air Conditioning Bureau, which will be held at the New Ocean House, Swampscott, Sept. 12. The program will include various outdoor sports, golf at the Tedesco Country Club, and some indoor sports, to be followed by a big dinner and entertainment in the evening.

Participating organizations include the Air Conditioning Manufacturers' Association; local chapter of the ASHVE, ASRE; Boston Oil Burner Associates, and National District Heating Association.

Fluid Fuels Up, Solid Fuels Down, Massachusetts Data Show

BOSTON—The relative importance of fuels used for home heating in Massachusetts, as shown by the annual survey made by the Division on the Necessaries of Life, Massachusetts Dept. of Labor and Industries, indicates an increased consumption of oil and gas, while deliveries of anthracite coal and coke showed decreases. Comparative figures for the 1937-1938 and 1938-1939 heating seasons are given below:

	1937-38	1938-39
Domestic anthracite, tons	2,483,000	2,320,000
Buckwheat anthracite, tons	192,000	176,000
Coke, tons	919,000	828,000
Bituminous coal, tons	823,000	805,000
Briquettes, tons	46,000	39,000
Oil, thousands of gallons	795,000	823,000
Gas, estimated M cu. ft.	3,269,266	3,480,500

Deliveries of domestic-sized anthracite showed a loss of 180,000 net tons from the previous year, while deliveries of coke decreased 90,000 net tons.

Consumption of oil increased 28,000,000 gallons over the previous year and over 100% from the 1933-1934 heating season figure.

Engineer Needed by N. Y. Schools

NEW YORK—The New York City Civil Service Commission is receiving applications for the position of Assistant Superintendent of School Buildings in Design and Construction. The duties are to supervise and direct the branch of specifications and construction for the Department of Education in connection with the construction, heating and ventilating, plumbing, and electric work of new school buildings and additions to existing buildings and additions.

The position is open to persons of all ages. Further information can be obtained from the New York City Civil Service Commission, 96 Duane St., New York, N. Y. When writing for an application, send a self-addressed 9-in. envelope with 6 cents in stamps. Applications will be received up to and including September 29.

4200 Tons of A.C. in One Building

WASHINGTON—A contract for seven centrifugal refrigerating machines to supply cooling for the new Social Security Building now under construction here has been awarded to Carrier Corporation.

This installation will be, it is said, the largest single refrigeration installation to be made at one time for a single building in the history of the air conditioning business. The seven refrigerating machines will supply 4,200 tons of cooling for the building's conditioning system.

Japanese Beetles Prefer to Bake, Nearly Die in Conditioned Air

WORLD'S FAIR, N. Y.—One of the many demonstrations at du Pont's Wonder World of Chemistry is that where Japanese beetles are shown to ignore plants sprayed with a liquid made by du Pont. It becomes a problem to round up sufficient beetles to supply this demonstration, and this problem is in the hands of Dr. M. D. Leonard, an entomologist who has a wide knowledge of these bugs.

In fact, Dr. Leonard is fascinated by the whole subject of Japanese beetles. He has made a thorough study of their habits and personalities, and can tell you dozens of little stories to illustrate his theory that they are endowed with an extremely perverse nature.

"Just to show you how perverse they are," he says, "I'll give you this illustration. We have a nice air-conditioned room in the Wonder World, but this doesn't suit the beetles at all. They like it hot and humid, and we have lots of trouble keeping them alive.

"So, one day when the beetles were lying around on their backs ready to expire any minute, the electricity supply failed at the Fair and our air-conditioning plant stopped.

"Well, sir, while the rest of us started perspiring, the beetles got right up off their backs, completely revived. They set to work chewing, and in a few minutes they had the smart weeds completely stripped down. They even ate most of the sulphur-sprayed plants, which they hated."

11,275 Hp. of A.C. Added in N. Y.

NEW YORK—Air conditioning installations connected to the lines of the Consolidated Edison Company of New York, Inc., during the first 7 months of 1939, totaled 350, with a capacity of 11,275 hp. Of these, 223 installations totaling 88,130 hp. were in Manhattan; 21 installations of 394 hp. were in the Bronx; 42 installations of 473 hp. were in Brooklyn, and 64 jobs of 1578 hp. were located in Queens.

N.J. Votes Money for Garage Vents

TRENTON—New Jersey's Legislature has approved a special appropriation of $32,500 for installation of air vents in the inspection stations of the state motor vehicle department. Action was taken following complaints from several stations that carbon monoxide fumes from the exhausts of motors are dangerous, especially in the winter when most of the windows are closed.

Industrial Advertisers Meeting to Feature Marketing Clinics

NEW YORK—The heating and air conditioning industries and their suppliers will be prominently represented at the 1939 conference of the National Industrial Advertisers Association, to be held here Sept. 20-22 at the Hotel New Yorker.

Leaders of eleven advertising clinics, which during the conference will analyze problems submitted by the association's membership, will include Terry Mitchell, Frick Co.; J. L. Rosenmiller, sales promotion division manager, York Ice Machinery Co.; Stuart Philips, Dole Valve Co.; Harry Neal Baum, advertising and publicity manager, Fairbanks, Morse & Co.; J. M. McKibbin, advertising and sales promotion manager, Westinghouse Electric & Manufacturing Co.

Also, Charles C. Chamberlain, advertising manager, Jenkins Bros.; H. H. Simmons, advertising manager, Crane Co.; Richard W. Harrison, Waukesha Motor Co.; Guy Bartlett and Robert Gibson, General Electric Co., and W. J. Chappell, Timken Silent Automatic Division, Timken-Detroit Axle Co.

Gritschke Engineers S.A. Building

In the description covering the installation of storage refrigeration for the air conditioning plant of the Salvation Army Headquarters Building in Detroit which appeared in the August issue of HEATING & VENTILATING, the author of the article, C. F. Boester, was erroneously credited as air conditioning engineer for the building. We are informed that the consulting mechanical engineer was E. R. Gritschke of Chicago, Illinois, who was retained by the architect, A. C. Fehlow of Chicago. M. Boester was responsible for the design of the ice accumulating coils rather than for the design of the entire installation.

Lehigh U. Plans A.C. Conference

NEW YORK—Tentative plans for an air conditioning conference to be held at Lehigh University November 10-11, under the sponsorship of The American Society of Refrigerating Engineers, have been formulated. Cooperation of other engineering groups is expected in this event.

Burner Standards in Effect Nov. 1

WASHINGTON — The recommended commercial standard for automatic mechanical draft oil burners will be effective beginning Nov. 1, according to an announcement by I. J. Fairchild, Chief, Division of Trade Standards, U. S. Department of Commerce.

Chicago July A.C. Jobs Total 345

CHICAGO—Thirty-three central systems and 312 room coolers made up the 466½ tons of air conditioning connected to the lines of the Commonwealth Edison Company during July, according to a statement from the air conditioning department of that utility.

The room cooler installations consisted of 60 in doctors and dentists offices, 138 in private offices, 111 in residences and 3 miscellaneous.

Of the central systems, which total 316½ tons, the largest installation was that in the Playdium Inc., 60 tons, followed by a 30-ton installation in the offices of the Bell Savings Building and Loan Company.

Cold Spring Found to Cool Court

PHILADELPHIA—During the excavation for the new Municipal Court Building, now in process of construction at 18th & Vine Streets, there was uncovered a hidden spring which has a flow estimated at 400 gallons per minute. WPA approval has been received for the plans to use this spring in air conditioning the building at a large saving to the city in the operation of the air cooling system.

The building is approaching 50% completion.

Manitoba Chapter Elects Davis

WINNIPEG, MAN.—G. C. Davis, vice-president of the Winnipeg Heating Co., was recently elected president of the ASHVE Manitoba chapter, and was installed at a joint meeting of the Manitoba and Minneapolis chapters at Detroit Lakes. Paul Charles was elected vice-president, and Ivan McDonald, secretary.

Frederick E. Hartmann

OMAHA—Frederick E. Hartmann, 54, general sales manager of the Baker Ice Machine Company, was found dead in bed August 7, in his Omaha home.

Mr. Hartmann joined Baker Ice Machine Company as a mechanic in 1905, a year after it was organized. He had been general sales manager for the last 6 years. Before that he was district sales manager. During the world war he was a chief engineer in the merchant marine. He was a member of the American Society of Refrigeration Engineers and the Omaha Engineers Club.

Claude A. Bulkeley

PHILADELPHIA—Claude A. Bulkeley, author of numerous engineering papers and of the Bulkeley psychrometric charts, died at Idylease sanatorium July 9.

WITH THE MANUFACTURERS

Oil-O-Matic Founder Retires

BLOOMINGTON, ILL.—C. U. Williams, for 21 years president of the Williams Oil-O-Matic Heating Corporation, has retired and is succeeded by his son, W. W. Williams, who has served as vice-president during the company's entire life.

C. U. Williams

Williams Oil-O-Matic is one of the oldest and best known companies in the oil burner industry, dating back to 1918. During the war, the elder Mr. Williams had designed some oil burning equipment for the Government. In 1918 he applied that knowledge and experience toward developing an automatic fuel oil burner to solve his own heating problem. Eventually the Williams Oil-O-Matic Corporation was formed.

Cooling Tower Makers Organize

NEW YORK—Headquarters of the newly organized Water Cooling Tower Association have been established here at 11 East 44th St. This Association was organized at a meeting held in St. Louis in July at which time L. T. Mart, president of The Marley Co., Kansas City, was elected president. At that same meeting W. J. Hoffmann of the Lillie-Hoffmann Cooling Towers, Inc., St. Louis, was elected vice president while W. J. Parker, New York, was elected secretary-treasurer.

Members of the Association include The Marley Co., Lillie-Hoffmann Cooling Towers, Inc., Schubert-Christy Corp, Binks Mfg. Co., and Foster-Wheeler Corp. Organization matters, including the formation of committees, are now under way, while a meeting of the Association has been announced for September 22 in New York.

At the Industrial Unit Heater Association meeting: (left to right) Mr. Resch of McQuay, Inc., Mr. Erstrom of the Patent License office and Reuben Trane of The Trane Company.

Unit Heater Makers Hold Meeting

SKYTOP, PA.—This resort was the scene of the recent two-day meeting of the Industrial Unit Heater Association. Attention at the meeting was focused on the work the Association has been doing in the standardization of piping and motors. This latter move has saved the industry countless thousands of dollars because the number of motors specified for use with unit heaters has been reduced from over a thousand to about fifty.

Ninety-three per cent of all unit heaters sold are manufactured by members of this Association. Through this close collaboration of the leading manufacturers in the field it has been possible to make great strides and improvements in the method of distribution to eliminate expensive selling.

1939 Equipment Sales Are Up

WASHINGTON—Sales of heating and air conditioning equipment for the first half of 1939 showed, for the most part, a considerable gain over the corresponding period in 1938, according to figures released by the Department of Commerce.

Non-ferrous convectors showed a gain of 121% over 1938, steel heating burners an increase of nearly 63%, and oil burners a gain of nearly 56%.

Air conditioning equipment sales showed a gain of 15.3% over 1938, although indirect heating surface declined 39%. The accompanying tabulation summarizes the sales data.

SALES OF EQUIPMENT, 1939 vs. 1938

(Figures are for first 5 months unless equipment name is followed by (6))

EQUIPMENT	5 OR 6 MO. 1939	5 OR 6 MO. 1938	PER CENT CHANGE
Oil burners, number (6)	67,142	43,149	+ 55.7
Stokers, domestic, number (6)	22,430	20,526	+ 9.3
Non-ferrous convectors, 1000 sq. ft. (6)	3,812	1,728	+ 121.0
Cast iron convectors, 1000 sq. ft. (6)	2,848	2,681	+ 6.2
Cast iron radiators, 1000 sq. ft.	16,961	17,306	— 2.0
Round cast boilers, 1000 lb.	6,385	6,246	+ 2.2
Square cast boilers, 1000 lb.	59,120	51,833	+ 14.1
Steel heating boilers, number (6)	3,997	2,456	+ 62.9
Indirect heating surface, dollars	367,648	603,130	— 39.0
Unit heaters, 1000 dollars	1,796	1,370	+ 31.1
Unit ventilators, 1000 dollars	1,110	839	+ 32.4
Air washers, dollars	216,619	227,394	— 4.4
Fans and blowers, 1000 dollars	4,980	4,513	+ 10.3
Air conditioning equipment, 1000 dollars	12,156	10,551	+ 15.3

O'Mara Elected by NIAA Group

CHICAGO—Continuing its rapid growth, the National Industrial Advertisers Association has just granted a charter to the Industrial Marketers of Southern California, the third new chapter to be added within the past 12 months. N.I.A.A. now has nineteen chapters in all, with an individual membership of over 1300.

The new California chapter, with headquarters in Los Angeles, has elected the following officers: President, Richard O'Mara, Sales and Advertising Manager, Western Precipitation Corporation; Vice President, Don Mack, Advertising Manager, Weber Showcase and Fixture Company; Secretary-Treasurer, Martin R. Klitten, Account Executive, The McCarty Company.

Gas Furnace Sales Increase 101%

NEW YORK—Gas appliance sales throughout the United States increased sharply during the first six months of this year as compared to sales figures for the corresponding months in 1938, it was reported by C. W. Berghorn, managing director of the Association of Gas Appliance and Equipment Manufacturers from their national headquarters, 60 E. 42nd St.

Sales of gas-fired furnaces registered an increase of 101% for the first six months of 1939 over sales of the same months in 1938, while sales of gas-fired boilers registered a rise of 5.6% in the same period.

Fan Manufacturers to Expand Data

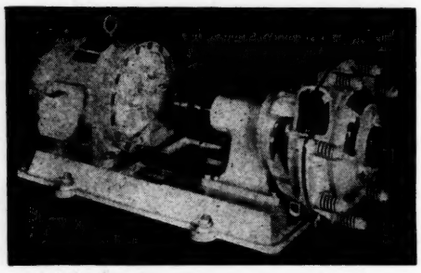
DETROIT—The summer meeting of the National Association of Fan Manufacturers will be held at Manchester, Vermont, September 14-16. At that time consideration will be given to further additions to the established standards and working data now published and distributed by the Association. The response for such information by the architect, engineer and buyers of fan equipment has encouraged the Association to enlarge the scope of this activity.

(Concluded on page 73)

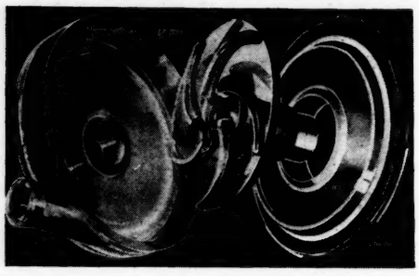
NEW EQUIPMENT

Nash Glass Pump

NAME—Nash glass centrifugal pump.
PURPOSE—For pumping chemical or food products under sanitary conditions or where the products handled must remain chemically unchanged. Also for pumping corrosive materials in commercial quantities.
FEATURES—Pump is made of Pyrex brand heat and shock resisting glass, and impeller and casing are said to be not affected by temperatures up to 150F in standard design, and 200F in special design. Either hot acid or brine cooled liquids may be pumped. The pump is fully transparent and the interior is subject to examination at all times. Cleanliness of the interior and the color and sedimentation of the material passing through may be constantly checked without stopping the pump. It is said the pump may be cleaned in a short time as the whole interior may be laid open in a few minutes. Reassembly is accomplished quickly and the proper adjustment is practically automatic. Glass parts are protected by a cast-iron bracket and cover plate housing. These cast-iron parts are properly plated or coated with a material resistant to the substance being handled. Excessive pressure is relieved automatically if for any reason it should develop in the interior of the pump. Under normal operation the unit can operate with a static pressure on the suction of 20 lb. per sq. in., and discharge pressures up to 50 lb. per sq. in. Pump was conceived by the Corning Glass Works.
CAPACITY—6000 gal. liquid per hr.
MADE BY—*The Nash Engineering Company, South Norwalk, Conn.*.....1



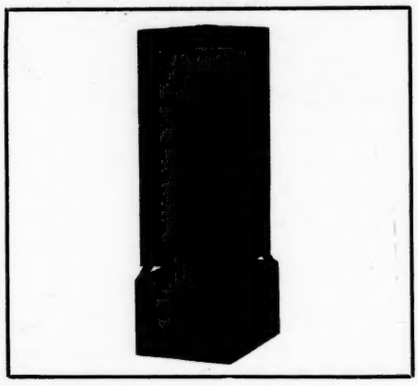
Exterior Nash centrifugal pump.



Pyrex glass casing and impeller.

Aqua-Sorb Dehumidifying Unit

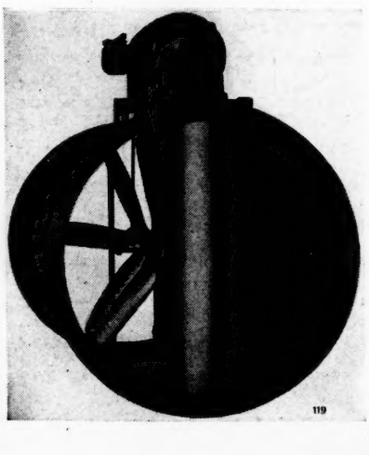
NAME—Aqua-Sorber.
PURPOSE—To overcome dampness and high humidity.



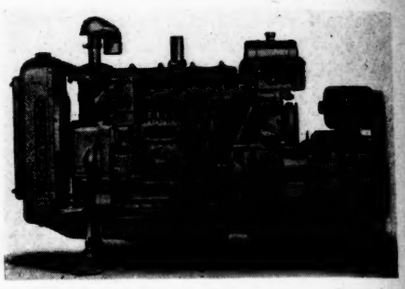
FEATURES—Manufacturer offers two models. The first model, BH 100, consists of a metal cabinet 15 in. sq. and 42 in. high. This unit consists of a centrifugal blower, which is controlled by a humidistat mounted on the outside of the cabinet, a filter bed of absorbent material upon which is placed a 100 lb. charge of Aqua-Sorb and a drip-pan. In operation the air is drawn into the unit and passed through the bed of Aqua-Sorb, which extracts moisture from the air. The moisture absorbed forms a brine which flows downward through the filter bed, picking up more moisture and becoming progressively more and more diluted. The Junior model contains 40 lb. of Aqua-Sorb and is ordinarily operated without blower or humidistat, but can be equipped with both or either, as required. This unit is 10 x 10 in. by 18 in. high.
MADE BY—*Aqua-Sorb Company, East Orange, N. J.*.....2

Hartzell Propeller-Type Blower

NAME—Propeller-type blower.
PURPOSE—For moving high temperature air or air in which the presence of acids or other elements might damage the motor.

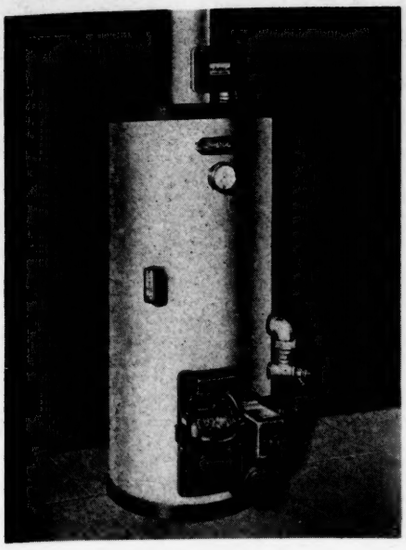


FEATURES—Unit consists of a propeller type blower with the motor located on the top of the blower housing. One side of the platform on which it rests is hinged and lock bolts on the opposite side can be adjusted to tighten or loosen the belt or to change it. A V-type belt is used to transmit power from the motor to the fan shaft and this belt can be replaced from outside of the blower. The propeller fan is of a special type and is claimed to give high air deliveries against heavy back pressures.
SIZES—12 standard sizes with propellers from 18 to 48-in.
MADE BY—*Hartzell Propeller Fan Company, Piqua, Ohio*.....3



Caterpillar Diesel Generator

NAME—Caterpillar Diesel electric set.
PURPOSE—For generating electric current for driving air conditioning and refrigerating units.
FEATURES—Diesel electric sets are completely self-contained and are designed to provide low cost power for refrigerating and air conditioning equipment. All electrical equipment is in-built with the exception of a circuit breaker and no extra equipment is required. Manufacturer states that eliminating the need for auxiliary equipment makes these units much less expensive than the average Diesel electric set. Engines have three operating adjustments none of which involves the Diesel fuel systems. Built-in regulation enables the sets to pick up relatively large motor loads with little voltage drop.
SIZES—Two sizes available, Model 34-15 supplied in 3-phase, 110, 220 or 440 volts at 15 kw., 0.8 power factor, also available as single phase 110/220 three wire type and 110 and 220 volt two wire type at 13 kw., .8 power factor. The 44-20 set is supplied in 3-phase, 110, 220, or 440 volts, at 20 kw., .8 power factor. It is also available single phase, 110/220 volts, three wire type; and 110 and 220 volts, two wire type at 18.5 kw., .8 power factor.
MADE BY—*Caterpillar Tractor Co., Peoria, Ill.*.....4



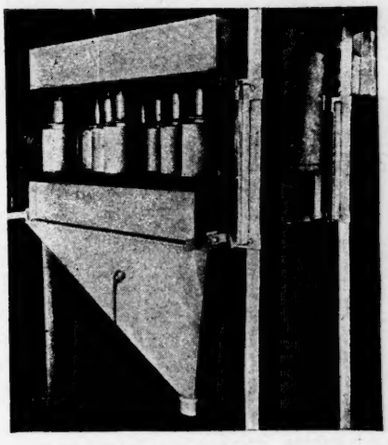
Anchor Boiler

NAME AND MODEL NUMBER — Fluid heat boiler, model WB-2.
PURPOSE—For heating small buildings, for supplying domestic hot water or both.
FEATURES — Boiler walls are made of 12 gage steel with heavy steel used for the heads. In the center flue is a 1-in. copper coil which serves as an exchanger and flue baffle and gives the effectiveness of extended and water backed surfaces. A built-in combustion chamber extends the full height of the boiler base. A drain valve for flushing boiler and coil assembly is provided. An indirect domestic hot water heater can be externally connected to the boiler flow and return piping at the boiler. Standard equipment includes flange-mounted P-3C Fluid Heat oil burner, primary control, room thermostat, and limit control. Boiler is designed for 150 lb. working pressure. It is shipped completely assembled in a green jacket with insulation extending the full length of the boiler.
CAPACITY—Ranges from 475 to 785 EDR hot water depending upon oil burner nozzle size.
MADE BY—*Fluid Heat Div. of Anchor Post Fence Co., Baltimore, Md.*.....5

Prat-Daniel Dust Collector

NAME—Thermix Tubular dust collector.
PURPOSE—For removing dust from gases.
FEATURES—Small size and weight are the outstanding features of this dust collector. Manufacturer states that it can be installed in little more than the normal area occupied by a gas flue and that it may be installed vertically, horizontally or at any angle. The entire dust collector is surrounded by its inlet duct and dust hopper which is said to result in an effective economy of space and weight. Centrifugal apparatus is a series of steel tubes, each equipped with two slots in its upper half. Each slot has a directional vane on the exterior of the tube. The lower half of the tube, which is a cylinder, extends into the dust hopper through a tube sheet. The gas enters the inlet plenum chamber, and passes through slots in the tubes, rotating around a smaller central tube. The central tube extends to a point somewhat below the bottom of the slots in the outer tube, and upward to a tube sheet which forms the bottom of the outlet duct. The length of the tube determines the capacity and the dust collecting efficiency of the apparatus. A relatively short tube results in a collection efficiency in the neighborhood of 80% on pulverized fuel dust, but with a maximum capacity per tube. By lengthening the tube, the collection efficiency resulting is considerably higher, but the capacity per tube is reduced.

The dust is precipitated against the sides of the outer tube, as with the



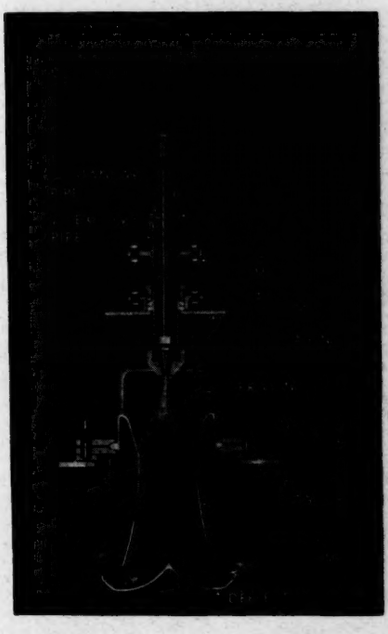
usual Thermix Multicyclone, and is carried down the walls of the tube into the hopper. The cleaned gas is evacuated through the smaller central tube, to the outlet duct. The apparatus, therefore, is a double inlet cyclone, without inlet arm, and without a cone for the lower part, and a relatively small diameter, usually about 6-in. The apparatus is constructed in sections, each with an assembly of tubes. These sections are completely assembled before shipment, and are of a size and weight convenient for handling in the field.
MADE BY — *Prat-Daniel-Corporation, Port Chester, N. Y.*.....6

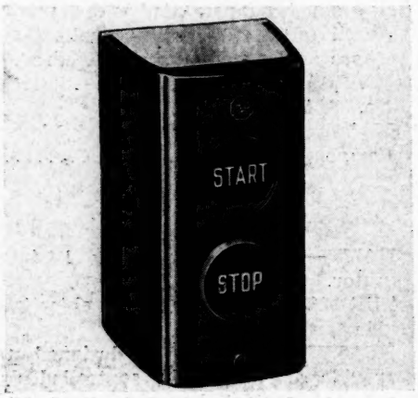
Autovent Fan Protective Coating

NAME—Heresite.
PURPOSE—A protective coating for use where fan wheels are exposed to extremely corrosive and highly concentrated acid or gas fumes.
FEATURES — This manufacturer is now offering fans coated with Heresite baked finish, for use in applications where acid proof fans are required.
LITERATURE AVAILABLE—Bulletin No. 201A.
MADE BY — *Autovent Fan & Blower Company, Chicago, Ill.*.....7

Brassert Stationary Disintegrator

NAME—Brassert Stationary Disintegrator.
PURPOSE—For removing objectionable fumes from air.
FEATURES—Device is designed to provide an accurately controlled degree of contact between gases and liquids. An application in the air conditioning field is the removal from air of objectionable odors which occur as fumes. Operation is based on the principle of producing a concurrent flow of gas or air and a very finely divided liquid spray at a high velocity through a venturi tube with an impingement on a surface at right angles to the direction of flow. Outstanding features claimed include (1), the degree of cleanness of the gas or air can be accurately varied. (2) The high pressure nozzle for water or other liquids in each unit may be changed or cleaned without interrupting the main operation. (3) Once adjusted for a given performance, it requires little attention, but can be quickly readjusted when conditions change in the liquids and gases being handled. (4) The contacting ability, when adjusted for specific conditions, is said to be nearly perfect for the exchange of heat between gases, vapors and liquids.
CAPACITY—Standard rating is one disintegrator unit per 1000 c.f.m. of gas or vapor measured at 60F and atmospheric pressure.
MADE BY—*H. A. Brassert Company, Chicago, Ill.* 8



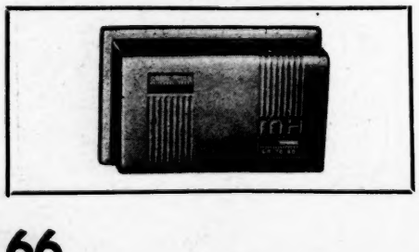


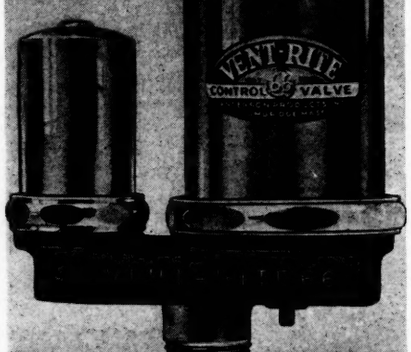
Allen-Bradley Push-Button Control Station

NAME—Bulletin 800 push-button control station.
PURPOSE—For controlling the operation of electrical equipment.
FEATURES—The enclosure of the new push-button stations consists of a reinforced bakelite cover mounted on a die-cast frame. This cover is furnished in black as standard, but may be provided in machine tool gray or in white. By removing a single screw, the cover can be taken off, exposing all terminals. Buttons are of molded red and black bakelite and are available with various markings engraved on them. The push-button stations are available in both horizontal and vertical arrangements and have a maximum rating of 3 amperes, 110, 220, 440, 550 volts.
MADE BY—*Allen-Bradley Co., Milwaukee, Wis.* *9*

M-H Thermostat

NAME AND MODEL NO.—Grad-U Stat TO900.
PURPOSE—A pneumatic thermostat for room temperature control.
FEATURES—Manufacturer states that this thermostat brings to the pneumatic control field the greater sensitivity, modern appearance, and improved results which have been available in electric thermostats for several years. Model is of the non-leak type and uses air only when it is changing the position of an air motor or valve. It is said that the quantity of air used, therefore, is very small and a compressor size is reduced by about 80%. The thermostat is horizontally mounted which results in the free flow of air over the low-mass sensitivity bellows because there is no restriction to the flow of air except in the grille work in the cover. This free flow is said to make the thermostat extremely sensitive. A single model of the Grad-U-Stat may be used as a direct or reverse acting thermostat and the throttling range of differential may be adjusted between comparatively wide limits. Sub-master, day-night, and summer-winter models are available through the addition of a small unit to the standard instrument. The manufacturer states that the instrument is capable of controlling twice as many damper motors and valves as the present thermostat and it is tamper proof since most of the operating mechanism is located behind the thermostat in the wall.
MADE BY—*Minneapolis-Honeywell Regulator Company, Minneapolis, Minn.* *10*



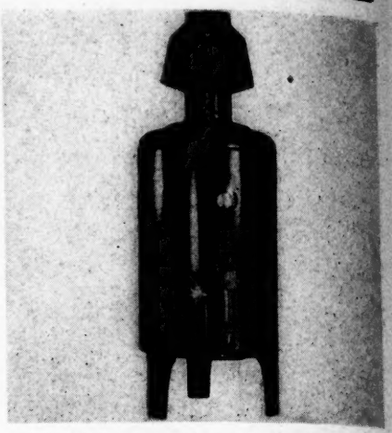


Anderson Vent Control Valve

NAME AND MODEL NUMBER—Vent-Rite control valve No. 66.
PURPOSE—For venting mains of one pipe steam heating systems and for controlling the vacuum.
FEATURES—The manufacturer states that this valve performs a triple duty. (1) It replaces the standard main line vent, operating as a quick vent. (2) It returns the system to atmospheric pressure at the beginning of each firing period. (3) It limits the creation of vacuum to 10-in.
SIZES—4⅜ in. high by 3¾ in. wide. ½ in. I.P.T. thread.
MADE BY—*Anderson Products Inc., Cambridge, Mass.* *11*

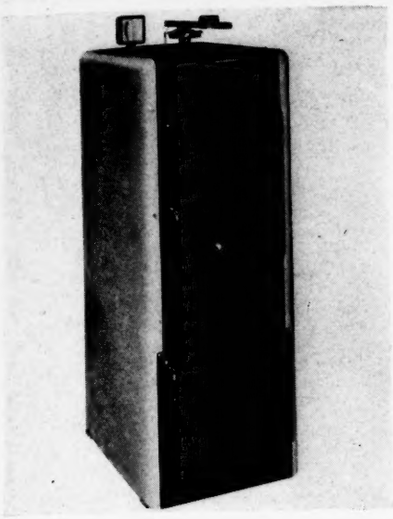
Burkay Water Heater

NAME—Burkay water heater.
PURPOSE—For supplying service hot water using gas as a fuel.
FEATURES—Manufacturer states that this water heater can be used as an instantaneous gas water heater supplying 5-gal. per min. (60F rise), as a booster to raise pre-heated water to sterilizing temperature or as a recovery heater to supply a large storage tank. Heating elements are of the finned type which is said to increase the speed of heating. The burner is of a new type and is only 8-in. in diameter. A thermostatic control unit is provided to regulate the amount of gas burned. Thermostat may be set to produce water at 180F, or higher as required. Unit stands 40-in. high.
CAPACITIES—5 gal. per min., 60F rise.
MADE BY—*Burkay Company, Toledo, Ohio.* *12*



Murray Stoker

NAME AND MODEL NO.—Murray Electric Stoker, Model No. 40.
PURPOSE—For overfeed firing of boilers and furnaces using anthracite or bituminous coal or coke.
FEATURES—Unit consists of a hopper, fuel feeding mechanism and fuel control device all mounted in a portable unit. In operation the coal is fed automatically to the top of the fire. When a fuel cone reaches the proper level the automatic fuel control lever shuts off the stoker. When the fuel cone drops below a certain level the fuel control sets the stoker in action. Manufacturer states that stoker requires no expensive installation as it is simply necessary to roll it to the boiler, adjust to height of firing door and plug into a light socket. Stoker is furnished with necessary thermostat and controls.
MADE BY—*The Murray Corporation of America, Detroit, Mich.* *13*

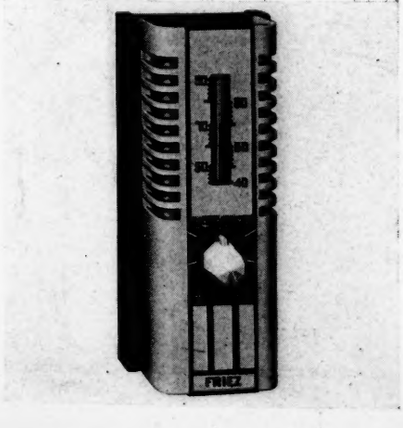


National Heat Extractor Boiler

NAME—National No. 1 series heat extractor.
PURPOSE—A boiler designed for the small house market and to be used with coal, oil, and gas with either steam or hot water.
FEATURES—Can be installed on first floor when basement is not available. Intermediate sections provided with extended heating surface and flues broken up into five passages. Of wet bottom design. New rocking beam type draft control provided. Sections have ground surfaces for drawing up iron to iron. Boiler jacket in red and black.
SIZES AND CAPACITIES—Available in 4 sizes with net loads for coal models from 170 to 350 sq. ft. of steam radiation or 275 to 550 sq. ft. of hot water. Ratings for oil-fired models from 230 to 430 of steam and 370 to 680 sq. ft. of hot water.
MADE BY—*National Radiator Company, Johnstown, Pa.* *14*

Friez Thermostat

NAME—Friez Microstat.
PURPOSE—A low priced thermostat for low voltage control of heating or cooling equipment.



FEATURES—Thermostat operates on 25 volt, 2 amperes maximum. Case covers a switch mechanism suspended from a single point and featuring 'Alnico' magnets, heat-treated bi-metals, and gold contacts. Manufacturer states that the well ventilated case with a built-in thermometer insures greater sensitivity and that an exceptionally close differential control is provided by a simple adjustment. Case size 3½x1½x1½ inches.
MADE BY—*Julien P. Friez & Sons, Baltimore, Md.* *15*

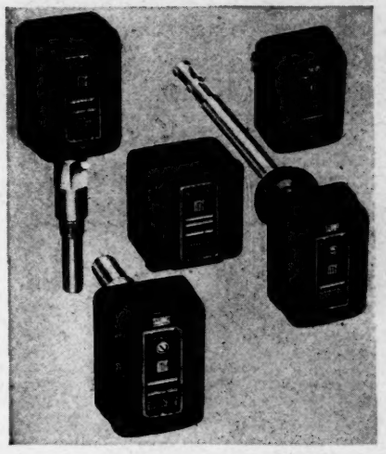
Taylor Welding Fitting

NAME—"Centring" WeldELL.
PURPOSE — Easily installed welding pipe fittings.
FEATURES—The outstanding feature of these seamless forged steel welding fittings is the annular lip which is forged integral with the fittings. This lip is said to eliminate the need for backing rings, clamps and guides for

holding the fittings in position and is said to greatly simplify and expedite pipe welding. The manufacturer states that the ring remains cooler during the welding time than molten weld metal. As a result the bottom of the "V" appears darker than the sides. This color contrast is said to be an ideal guide to the welder permitting him to obtain complete penetration without burning through. In this line of welding fittings the features of the standard line of Taylor Forge Weld-ELLS have been preserved.
SIZE—Eight sizes from 3 to 12 in. in either standard pipe thickness or in extra strong pipe thickness.
MADE BY — *Taylor Forge & Pipe Works, Chicago, Ill.* *16*

M-H Limit Controls

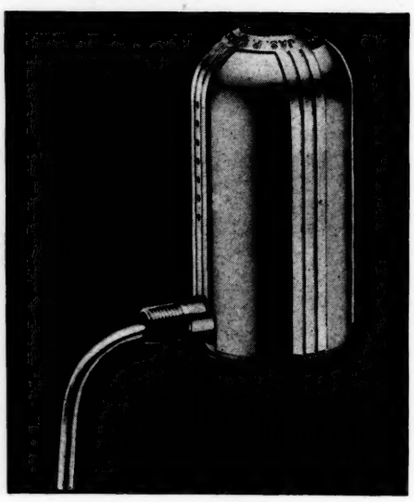
NAME — Minneapolis-Honeywell limit controls including pressuretrols, aquastats, airstats and furnacestats.
PURPOSE—A new line of this company's limit controls.
FEATURES—Styled by Henry Dreyfus. Small and compact, but at the same time ample terminal space is



provided. The differential adjustment mechanism used in the furnace controls and aquastats is such that the differential can be changed instantly with one finger. All of the controls have visible scales and external adjustments except that the differential adjustment is concealed to avoid tampering. Devices have bi-metal actuation. The pressuretrol bellows are located within the case. In the furnace control the ball and socket and stem have been greatly reduced in size and the helix is guarded to prevent damage in transit.
MADE BY — *Minneapolis-Honeywell Regulator Company, Minneapolis, Minn.* *17*

Modine Convectors

NAME—Quiet-Seal.
PURPOSE—For use with one-pipe steam systems.
FEATURES — Manufacturer states that noiseless operation, no spitting and full heating capacity are the outstanding features of this new convector. It is said that the convector permits the simplified piping arrangement characteristic of one-pipe steam plans. Convector operates on a one-way principle, allowing steam, condensate and air to flow in the same direction, insuring full convector capacity at all times. A built-in trap of water seal is said to eliminate water hammer noises and squirting from air vents. This seal also permits easy venting of the convector and prevents air binding. Heating capacity is said to be equal to that of an ordinary two-pipe convector of the same size.
MADE BY—*Modine Manufacturing Co., Racine, Wis.* *18*

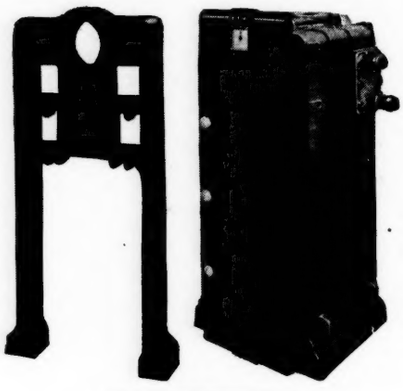


Marsh Automatic Air Valves

NAME AND MODEL NO.—Marsh Airliner Air Valves No. 1-1A and 2-2A.
PURPOSE—Venting steam radiators.
FEATURES—The manufacturer states that valves are silent in operation because vent air after leaving the vent port enters an outer chamber of the valve where its velocity is dissipated by expansion. From this outer chamber the air passes through multiple ports in the outer shell. Spraying is said to be eliminated by a baffle plate which deflects the spray into a float chamber. Spitting is said to be eliminated by a separate float chamber which is provided with small drainage ports. Valve No. 1 is a non-adjustable type while valve No. 1A has an adjustable venting. Valves No. 2 and 2A are of the vacuum type and have sensitive and powerful bellows for holding the vacuum. Valve No. 2 is of the non-adjustable type while valve No. 2A is of the adjustable venting type. All valves are furnished with a satin finish and highly polished ribs. Adjustable venting valves have a tamperproof vent adjustment which requires a screw-driver for adjustment.
SIZES—Valves are available in ⅛-in. angle pattern; ⅛ and ¼-in. straight pattern; ¾-in. male pattern and ⅜-in. IPS female pattern.
MADE BY—*Jas. P. Marsh Corporation, Chicago, Ill.*.....*19*

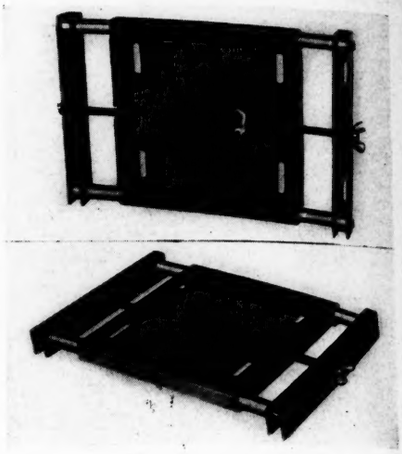
Burnham Boiler

NAME—Junior Yello-Jacket boiler.
PURPOSE—For supplying steam or hot water.
FEATURES—Section legs of boiler have been extended to form the base making what is equivalent to a one-piece boiler as it is shipped with its three sections all assembled. To further cut down installation costs, the jacket is made in only four pieces which slip together easily. Although this is an all fuel boiler, only the oil model is ready for the market. There is a removable extension to the jacket for those who desire the burner enclosed.
CAPACITY—Model YS-1-A, 300 sq. ft. installed radiator steam. Model YW-1-A, 480 sq. ft. installed hot water radiator.
MADE BY—*Burnham Boiler Corporation, Irvington, N. Y.*.....*20*



Ideal Motor Base

NAME—Ideal automatic tension motor base.
PURPOSE—For automatically maintaining correct belt tension.
FEATURES—To take up slack in belts due to normal wear and stretch it is only necessary to give the adjusting screw a few turns. The base then moves back giving the correct belt tension. Spring tension holds the motor, takes up slack and cushions the load shock that might otherwise damage the motor and bearings. It is said that installation is easy since the motor is mounted directly on a sliding plate of the base. The complete motor and base is then bolted down as a unit. In changing of belts, it is only necessary to release the spring tension and place a new belt around the sheaves. Base may be used with horizontal, vertical or overhead drives and is said to operate satisfactorily with any type of load either pulsating, steady or reversing.
MADE BY—*Ideal Commutator Dresser Co., Sycamore, Ill.*.....*21*



Hays Flue Gas Analyzer

NAME—Orsatomat.
PURPOSE—For automatically analyzing flue gases.
FEATURES—Incorporated in this new model is a transparent plastic tilting analyzing unit, which is said to be smaller, lighter in weight and more compact than the unit in the old model. It is housed in a newly designed streamlined pressed steel case, along with a draft measuring and indicating unit. If desired, a flue gas thermometer may also be fitted inside the case. The Orsatomat may be had simply for analyzing for CO_2 or in a two unit model for analyzing for CO_2 and O_2. Device is portable as it weighs 12 lb. fully charged. It is finished in a grey lacquer with chromium trim.
LITERATURE AVAILABLE — Publication No. 39-366.
MADE BY—*The Hays Corporation, Michigan City, Indiana*.....*22*

TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

On the list below circle the item number of the equipment in which you are interested, using the number found at the end of each item.

1 2 3 4 5 6 7 8 9 10 11 12 13 14
15 16 17 18 19 20 21 22

(This service available only to engineers or executives)

Fill in your name and address, detach and mail to
HEATING & VENTILATING, 148 Lafayette St., New York, N. Y.

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CAMPION

A JESUIT HIGH SCHOOL

PRAIRIE DU CHIEN, WISCONSIN

Dec.24, 1938.

Sterling Engineering Co.,
Milwaukee, Wis.

Mr.C.J.Rice.

Dear Sir:

The writer is pleased to say that your Thermotrols have demonstrated their value and we will keep same. You may send bill covering this account.

Just how soon I will be permitted to order some more, I can't say now. However, the fact that Direct Radiator Control is correct, has been AND IS BEING demonstrated every day by the Thermotrols now connected.

In the interest of CAMPION and economy of coal, I will continue to advise the use of more THERMOTROLS.

Yours very respectfully,

Wm.N.Schneider.

Wm.N.Schneider.

●

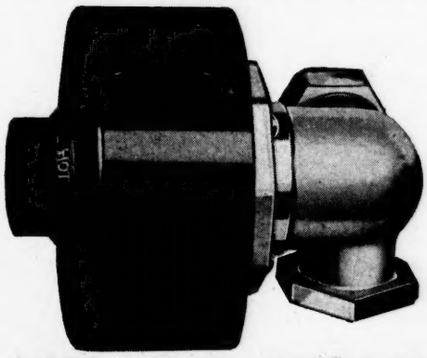
Sensational FUEL SAVINGS, greater heating comfort and convenience, low original cost and installation cost, place THERMOTROLS in high favor with Heating Engineers and their customers. Sterling Thermotrols, completely self-contained, are quickly and easily installed on individual Steam, Vapor, or Hot Water Radiators. They provide Thermostatic Regulation of individual Room Temperatures — preventing overheating, fuel waste, offering more healthful, steady room temperatures.

●

In the interest of Coal Economy

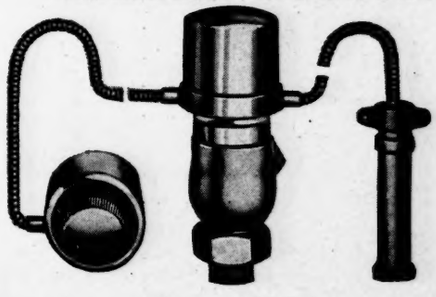
I advise using . . The Thermotrol

• *for* **EXPOSED RADIATORS**



- An Automatic Room Temperature Control applied to INDIVIDUAL Radiators.
- Completely Self-contained — requires no motors, electrical connections, or separate room Thermostats.
- Easy to Install.
- Low First Cost.
- Low Installation Cost.

• *for* **MODERN CONCEALED RADIATORS**



★ **FOR HOMES, OFFICE BUILDINGS, HOTELS, APARTMENTS, HOSPITALS, SCHOOLS**

STERLING ENGINEERING CO. 3732 N. Holton St. MILWAUKEE, WIS.

Summer Degree-Hours for July

THE number of variables which affect the summer air conditioning load is high, and the dry-bulb temperature of the outside air is of much less importance among the other variables than it is in connection with winter heating. It is doubtful if any one single factor can ever be used to show load proportionality for different types of buildings in the summer as it can in winter with the degree day.

However, where there is little internal load, either sensible or latent, such as in residences, some such simple proportionality may exist. Research at both University of Illinois and by Detroit Edison Company indicates that the load unit for residences for summer may be the summer degree hour above 85F.

The figures below show the number of degree-hours of current interest for a number of cities.* To obtain them, 85 was subtracted from the hourly temperatures for each hour it was over 85F, and the results totaled for the periods.

The first two columns of figures are the degree hours totaled for July, 1939 and July, 1938. The third and fourth columns show the maximum and minimum number of degree hours experienced during the Julys in the eight-year period from 1932 to 1939, inclusive.

The fifth and sixth columns show the cumulative totals for the summer (1939 and 1938) up to and including July 31. The last two columns show these cumulative seasonal totals *for the year having the highest and lowest cumulative total up to July 31.*

In seven cities—Baltimore, Cincinnati, Columbus, Philadelphia, Pittsburgh, Richmond, and Washington—July, 1939, set new records for cool weather (in terms of degree-hours). Cincinnati, in fact, during this season has established a new low record for the season. No cities broke any high degree hour records for July or for the season.

*Maximum, minimum, and average seasonal totals of summer degree hours are included in both tabular and map form in the Air-Conditioning Engineers' Atlas, by Strock and Hotchkiss, The Industrial Press, 148 Lafayette St., New York. Price, $2.

SUMMER DEGREE-HOURS (ABOVE 85F)* JULY, 1939

City	July, 1939	July, 1938	July, Max.†	July, Min.†	Season, Total to July 31			
					1939	1938	Max.†	Min.†
Baltimore	271	513	1025	271	864	739	1871	691
Birmingham	814	586	1311	544	1087	928	2708	928
Bismarck	581	252	3241	252	685	364	3886	530
Boston	136	66	369	60	162	147	587	136
Buffalo	24	2	47	0	25	4	107	4
Chicago	166	112	704	112	266	127	1533	127
Cincinnati	205	292	1883	205	356	360	2831	356
Cleveland	78	42	525	42	100	50	552	50
Columbus	273	372	1361	273	579	493	2239	434
Des Moines	921	988	4012	768	1460	1221	4836	1066
Detroit	288	95	1179	95	344	146	1329	146
Ft. Wayne	241	90	1796	90	390	120	2429	120
Grand Rapids	312	65	1425	65	454	107	1594	107
Houston	1347	985	1770	810	2254	1573	2667	1526
Indianapolis	326	241	2273	241	623	267	2727	267
Kansas City	2438	1927	4765	1065	3058	2203	8227	1702
Milwaukee	162	48	740	48	260	49	816	49
Minneapolis	429	127	2245	127	637	238	2384	238
New Orleans	1024	710	1458	634	1500	1425	2283	1262
New York	41	33	405	28	105	41	430	40
Philadelphia	154	197	636	154	470	282	1090	282
Pittsburgh	91	163	745	91	214	169	1055	169
Portland, Ore.	350	447	447	1	448	526	526	45
Richmond, Va.	220	259	925	220	753	364	1702	364
St. Louis	1005	1052	3687	567	1267	1214	5372	1135
San Diego	0	0	0	0	15	0	15	0
San Francisco	0	0	3	0	0	0	6	0
Savannah	854	347	1633	347	1709	1096	2241	1096
Toledo	217	111	1201	111	301	169	1511	111
Washington	216	466	988	216	715	689	1711	689

*Computed from data made available through the cooperation of the U. S. Weather Bureau.
†See text for definition of this term.

BADGER
EXPANSION
JOINTS

PROTECT YOUR STEAM LINES

Without Involving any Cost for Expansion Joint Maintenance

Protect them, too, with corrugated joints that are scientifically heat-treated throughout fabrication.

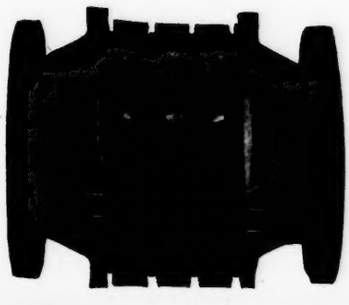
These two features . . . elimination of packing requirements and skilled heat treatment . . . coupled with Directed Flexing make the Badger Expansion Joint ideal for steam lines. Each feature saves the user money. Each reduces the cost of taking care of the necessary expansion and contraction in steam lines.

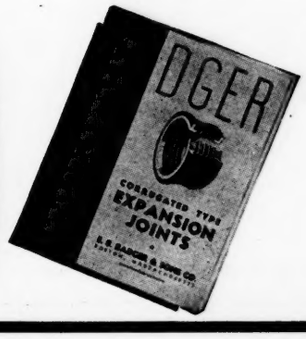
Badger has been making and applying the corrugated type of expansion joint for nearly 50 years. The Badger Expansion Joint as made today has all that experience back of it and more. It has all the improvements that have been developed in this maintenance-saving type of expansion joint.

E. B. BADGER & SONS CO.

75 PITTS STREET, BOSTON, MASS.

Agents in Principal Cities





A full description, list prices, sizes and other important data are given in Bulletin 100. Send for your copy.

500 SARCO STEAM TRAPS

IN SERVICE 10 YEARS

Only 25 Replacements

"In ten years we have replaced only 25 trap elements on our heating system. It works perfectly and always has. Furthermore, the Sarco Hook-up with 8" vacuum on supply and 12" on the returns introduced steam savings that have paid for the equipment many times over.

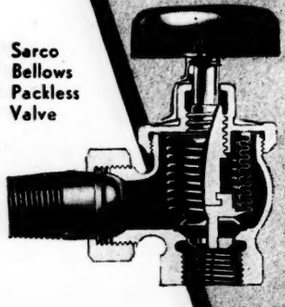
"Thousands of Sarco Steam Traps are used in large hospitals, office and public buildings in Detroit—many of them installed years before ours—and I have never heard anyone complain. You can't go wrong with Sarco."

Emil Jensen, Chief Engineer
Detroit "Times"

Sarco Radiator Trap

THE SARCO BELLOWS

shown at left is the actuating element that provides quick and accurate opening and closing and that has demonstrated its ability to perform years after its moderate first cost has been earned by the savings.



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SARCO TEMPERATURE CONTROL

and hot water blenders in several forms provide better hot water service with minimum costs.

SPECIAL SERVICE

is rendered to engineers and contractors. It costs nothing to secure an estimate of costs and savings. Write for Catalog No. 145.

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SEE PHONE BOOK FOR LOCAL SARCO REPRESENTATIVE

S-52

NEW TRADE LITERATURE

Controls. A standard size, 24-page bulletin K, illustrating and describing the Friez heating, refrigerating and air conditioning instruments and controls. Among the devices described are humidistats, thermostats, water valves and strainers, Windowstats, Comfortrols, refrigeration controls, limit and fan controls, stoker control sets, motor operators, recorders, velocity, draft and air filter gages, psychrometers, anemometers, and CO_2 indicators. JULIEN P. FRIEZ & SONS, BALTIMORE, MD. 23

Evaporative Condensers. A standard size 4-page publication D-350-2 on the Trane evaporative condensers. Takes up the applications of the evaporative condensers for cooling Diesel engines, dehumidifying liquids, transformer oil and quenching oil. Also gives information on the mechanical specifications, operation, installation, maintenance and selection of Trane evaporative condensers for these applications. THE TRANE COMPANY, LA CROSSE, WIS. 24

Motors. A 6-page standard size booklet F8485, describing Westinghouse capacitor motors of 1/20 to 3/4 hp. for unit heater, fan and blower applications. Motor provides ordinary speed operation with ordinary on and off switch, high and low speed operation with a two-speed switch and multi-speed operation with a speed controller. Booklet shows cutaway drawings, outline dimensions and typical installations of the units. THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, EAST PITTSBURGH, PA. 25

Radiator Valves. A 4-page standard size condensed catalog and price sheet covering the complete redesigned lines of Marsh radiator air valves and vents. Presented in a convenient form are the essential facts about Marsh valves together with list prices and net trade prices. The first page is devoted to the new basic features of these valves and vents while the remaining pages are divided into units showing each valve or vent, describing its features and listing price. JAS. P. MARSH CORPORATION, CHICAGO, ILL. 26

Refractories. A standard size 12-page catalog entitled, "Furnace Refractories." Describes the characteristics and uses of Carbex, a manufactured refractory, which is used in all types of boiler furnaces and comes in a wide variety of shapes. Booklet also describes the Steel Mixture refractory which is a composition of specially selected ground flint clays. This material is available in the form of bricks, baffles, tile, complete combustion chambers, and cement. MCLEOD & HENRY CO., TROY, N. Y. 27

TO OBTAIN COPIES OF TRADE LITERATURE listed in this issue, circle on the list below the publications wanted, using the item number at the end of each review; fill in your name and address, mail to

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WITH THE MANUFACTURERS

Airo Supply Co., Chicago, Ill., has appointed *Karl Bergquist* to its staff as contact service man in Chicago and vicinity for the company under the direction of *E. W. Scotten,* store manager. Mr. Bergquist was formerly manager of the refrigeration parts division of Borg-Warner.

American Machine and Metals, Inc., DeBothezat Ventlating Equipment Division, East Moline, Ill., has added *Guy E. Waller* to its sales force. Mr. Waller will call on the trade in the Chicago area.

American Machine and Metals, Inc., East Moline, Ill., has appointed *Wayne Mendell* to supervise the sales activities of the *DeBothezat* Ventilating Equipment Division and other divisions of the company in the Chicago area, with headquarters at 35 East Wacker Drive.

The American Rolling Mill Company, Middletown, Ohio, has appointed *F. E. Wortley* as manager of midwestern sales area of the company. He was formerly manager of their district sales office. *Henry L. Woods, Jr.,* who has been attached to the sales office in Detroit, has been appointed manager at Cleveland to succeed Mr. Wortley.

Conco-Sampsel Stoker Corp., Mendota, Ill., has appointed *Harold W. Winningham* as western sales manager of the company. Mr. Winningham will cover the 12 western states, the Canadian provinces of British Columbia and Alberta, and the territory of Alaska.

Electrol Incorporated, Clifton, N. J., has appointed *J. Ledwidge* and *J. B. Walsh* to its field sales force. New dealers recently appointed are: James Marshall, Johnstown, N. Y.; Hudson Falls Hardware Co., Hudson Falls, N. Y.; Giroux & Adams, Westport, N. Y.; Carson Bros., Saranac Lake, N. Y.; John F. Leary, Little Falls, N. Y.; William Brown, Lowville, N. Y.; Rudolph Kany, Dolgeville, N. Y.; Raymond J. Morris, New Paltz, N. Y.; Alfred Berry, Norwich, Conn.; Brown Bros., Middletown, Conn.; Aaron & Co., New Brunswick, N. J.

Frick Company, Waynesboro, Pa., has appointed *Cyril Leech* as manager of its branch office at 718 Witherspoon Bldg., Phila. Mr. Leech has been engaged in refrigerating engineering work since 1922. Since 1935 he has been assistant to *H. B. Pennington,* former Frick branch manager, who has now retired.

General Electric Company, Air Conditioning and Commercial Refrigeration Division, Bloomfield, N. J., has appointed *H. T. Hulett* as sales manager in charge of distribution activities. Mr. Hulett formerly headed commercial refrigeration activities at Cleveland. *Elliott Harrington* has been appointed product sales manager and *S. Martin, Jr.,* has been named manager of the installation and service division. *Glenn Gundell* will continue as manager of the advertising and sales promotion division. The product sales division under Mr. Harrington will include five sectional managers as follows: *C. M. Rowland,* manager of specialty sales; *A. E. Pierce,* manager of heating sales; *D. W. McLenegan,* manager of engineering sales; *L. T. Brockbank,* manager of national user sales, and *F. H. Faust,* manager of commercial engineering.

The Mercoid Corporation, Chicago, Ill., announces that its Boston office is located at 839 Beacon Street *Burt Power* is in charge.

Sam, you better SCRAM!

WHEN the last gurgle of water makes its exit from the water glass, about the only thing left to do is kill the fire and run for cover. But if Sam is like most people who tend boilers, he'll probably scramble to the feed valve and send a big stream of cold water into an over-heated boiler. You know the rest of THAT story.

The simple point is that no one under the sun knows when a steam boiler may lose its water—or what may happen to it when it does. No gauge glass is watched closely enough to safeguard the boiler from low water. In fact, in these days of automatic heat they are watched less than they ever were. This, along with higher rates of firing, has made the low water hazard greater than ever before.

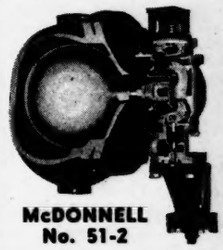
But the pleasant side of the picture is that McDonnell Boiler Water Level Controls are more dependable than they ever were before—and that is *something* in dependability.

This very minute, with the heating season right around the corner, ask yourself whether it is good business to permit any boiler—hand, oil, stoker, or gas fired—to go through another season without McDonnell Boiler Water Level Control.

There is a type for every size of boiler operating at any pressure up to 150 lbs. Two typical units are briefly described opposite Write for complete description, prices, service recommendations, and installation data.

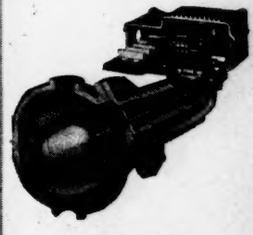
McDONNELL & MILLER
1313 Wrigley Bldg., Chicago, Illinois

"Doing One Thing Well"



McDONNELL No. 51-2
—for large, low pressure boilers

A feeder and cut-off combined — for automatically fired steam boilers above 5,000 sq. ft. capacity; operating at pressures up to 35 lbs. The feeder takes care of all normal operation, and the low water cut-off switch stops the burner if an emergency should arise such as extreme priming and foaming. For smaller boilers use the No. 47-2. Other types for higher pressures. All are made without the low water cut-off switch for use on hand-fired boilers.



McDONNELL No. 150
—for high pressure boilers

Here is the answer to water level control for the high pressure boiler It may be used as a low water cut-off — a cut-off and low water alarm — or combined cut-off and feed-pump control. Ask for typical hook ups.

McDONNELL

Genuine

Ric-wiL Type F Tile Conduit

REGISTERED IN U. S. PATENT OFFICE

RIC-WIL

CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES

Give you—

PERMANENCE

Rugged, durable construction results from interlocking design. Loc-liP side joints for easy cementing. Bell end joint gives positive seal and alignment.

HIGHEST EFFICIENCY

Assured by Ric-wiL Dry-paC Waterproof Asbestos Insulation—an exclusive Ric-wiL product obtainable with no other system.

DRYNESS

Best vitrified tile means water repellence. Substantial base drain foundation gives ample drainage and support. Closed construction throughout provides a system permanently tight, water-safe, and a minimum of 90% efficiency.

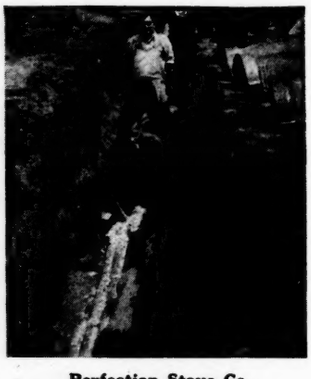
FAST INSTALLATION

Only 3 main pieces to each 2 foot of system—pipe supports which snap into place quickly—every precaution for low installation cost.

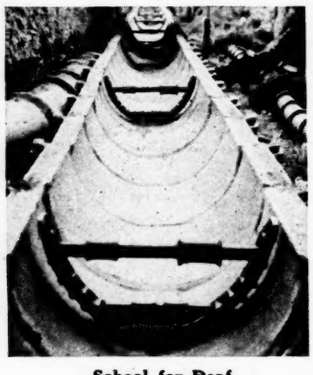
Ric-wiL also manufactures SuperTile Systems for use under ordinary traffic conditions, Cast Iron Systems for use under railway traffic, and Ric-wiL Insulated Pipe Units for use where a completely assembled prefabricated unit is desired. Descriptive bulletins on any or all types sent on request.

The RIC-WIL Co., Union Commerce Bldg., Cleveland, Ohio

New York *Agents in Principal Cities* **Chicago**



Perfection Stove Co., Cleveland, O.



School for Deaf, Greenburgh, N. Y.

The Lau Blower Co., 954 E. Monument Ave., Dayton, Ohio, has purchased a factory building at Home and Orchard Avenues, Dayton, as a new plant to take the place of their present location. The Company plans to erect an addition to the present L-shaped building making the completed plant rectangular in shape. When completed the plant will be a modern one-story industrial building with a floor area of approximately 55,000 sq. ft. Besides enabling the company to double its production capacity, the new plant will provide a modern laboratory in which experiments on all types of air conditioning will be conducted. When completed the plant will represent an investment of over $100,000.

D. J. Murray Mfg. Co., Wausau, Wisconsin, has appointed L. & T. Engineering Corp., 303 Midland Bldg., Kansas City, Mo., to represent them in that territory; Ray Heat & Power Co., 600 West Van Buren St., Chicago, will represent Murray in Illinois, Michigan, and Indiana.

National Warm-Air Heating and Air Conditioning Association, Columbus, Ohio, has appointed *Jan S. Irvine,* of Owens-Corning Fiberglas Corporation, a member of its merchandising committee.

Norge Division, Borg-Warner Corp., Detroit, has appointed *M. T. Bard* sales manager of its commercial refrigeration and air conditioning department and *C. L. Toonder* has been made commercial sales engineer. Mr. Bard has been assistant sales manager of the department since 1937, prior to which he was with General Electric's merchandising department. Mr. Toonder has been with Norge since January, 1937, and prior to that was with Smith, Hinchman & Grylls, Detroit consultant engineers, Carrier, Kelvinator and Clarage Fan.

Sterling Engineering Company, Milwaukee, has appointed *Eugene Jones,* 420 E. Wells St., Milwaukee, as its local representative.

H. A. Thrush & Co., Peru, Ind., has appointed *George J. Kollock,* 722 Sherwood Road, Atlanta, Ga., as its representative in Georgia, eastern Tennessee and southern Carolina. Mr. Kollock was formerly southern representative of the American Gas Products Division of American Radiator Company.

Vapor Car Heating Co., Inc., Chicago, has purchased the Kleen-Tube water heater business of Adams Engineering Company. *W. C. Keeran,* formerly chief engineer of Adams will head the new water sales division of the company.

Warren Webster & Company, Camden, N. J., has appointed *The Darby Corporation,* Kansas City, Kan., as its representative in Kansas, Oklahoma, Nebraska, western Missouri, and a portion of southwest Iowa. *Harry Darby,* president, *Leland W. Browne,* vice president, and *Harold C. Smith,* manager equipment sales division, will be active in connection with the Webster representation.

Wheelco Instruments Co., 1929 So. Halsted St., Chicago, Ill., has announced the appointment of two new dealers, *Industrial Equipment Co.,* 732 M & M Bldg., Houston, Texas, and *Frank P. Fischer,* 1608 Audubon St., New Orleans, La.

Whiting Corporation, Harvey, Ill. S. *H. Hammond,* vice-president in charge of the appliance division, announces the appointment of *Willis J. Erd* as assistant to the vice-president of the appliance division. Mr. Erd was formerly associated with the Federal Housing Administration in Wisconsin, Illinois and Washington.

COMING EVENTS

SEPTEMBER 20-22, 1939. Annual Conference, National Industrial Advertisers Association, Hotel New Yorker, New York. Headquarters NIAA, 100 East Ohio St., Chicago.

OCTOBER 4-6, 1939. Exposition of Building, Industry and Services, Hotel Statler, Detroit, Mich. Sponsored by the Mortgage Bankers Association of America. George H. Patterson, Secretary-Treasurer, 111 West Washington St., Chicago, Ill.

OCTOBER 5-7, 1939. Third annual joint meeting of the Fuels Division of the American Society of Mechanical Engineers and the Coal Division of the American Institute of Mining and Metallurgical Engineers. Headquarters at the Deshler-Wallick Hotel, Columbus, Ohio. Chairman of Arrangements Committee, R. A. Sherman, Battelle Memorial Institute, Columbus, Ohio.

OCTOBER 17-20, 1939. 68th Annual Meeting, American Public Health Association, William Penn Hotel, Pittsburgh, Pa. APHA headquarters, 50 West 50th St., New York.

OCTOBER 30-31, 1939. First fall meeting of the American Society of Heating and Ventilating Engineers, Atlanta, Georgia. Headquarters, Atlanta Biltmore Hotel. Chairman of Arrangements Committee, L. F. Kent, P. O. Box 1673, Atlanta, Georgia.

JANUARY 15-18, 1940. Sixth annual convention of the Refrigeration Service Engineers Society in conjunction with the Second All-Industry Refrigeration and Air Conditioning Exhibition sponsored by the Refrigeration Equipment Manufacturers Association, to be held in Chicago. National Secretary of the Society, H. T. McDermott, 433 N. Waller Ave., Chicago.

JANUARY 16-18, 1940. 35th Annual Meeting, American Society of Refrigerating Engineers, Hotel Blackstone, Chicago, Ill. ASRE headquarters, 37 West 39th St., New York.

JANUARY 22-24, 1940. Annual convention, National Warm Air Heating and Air Conditioning Association, Hotel Hollenden, Cleveland, Ohio. To be held in conjunction with the Sixth International Heating and Ventilating Exposition. NWAH & AC Assoc., Managing Director, 5 E. Long St., Columbus.

JANUARY 22-26, 1940. 46th annual meeting of the American Society of Heating and Ventilating Engineers, Hotel Statler, Cleveland, Ohio. To be held in conjunction with the Sixth International Heating and Ventilating Exposition. ASHVE, 51 Madison Ave., New York.

JANUARY 22-26, 1940. Sixth International Heating and Ventilating Exposition to be held at Lakeside Hall, Cleveland. Exposition under the direction of Charles F. Roth, International Exposition Co., Grand Central Palace, New York.

CERTAINLY, WE'VE GOT TO LINE THESE DUCTS...

"FOR QUIET...

We don't want any complaints about noise after this system is installed. We can line the ducts now with Airacoustic Sheets, without adding much to the cost of the job. They soak up more than 70% of all sounds in the duct. What's more, the system needs Airacoustic Sheets . . .

"FOR FIRE-SAFETY...

The National Board of Fire Underwriters has reported too many cases where combustible duct linings have caused serious fire losses. Airacoustic Sheets minimize this risk because they are basically mineral and will not contribute to the spread of fire."

You can use J-M Airacoustic Sheets for lining any type of duct. They are easy and economical to apply. And, once installed, the job is really finished. Humidity offers no costly maintenance problem, for Airacoustic Sheets are exceptionally moisture-resistant. They combine high transverse strength with low heat conductivity. You should have full details. Write Johns-Manville, 22 East 40th Street, New York, N.Y.

Johns-Manville AIRACOUSTIC SHEETS FOR DUCT LININGS